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GAS ENGINES.

Among the papers read at the Chicago Meeting the one published in our last issue, upon "Gas Engines," by Mr. Ramsdell, of Vincennes, Ind., furnishes much food for reflection, and we trust that it will not be laid aside without more than ordinary consideration. The paper was eminently practical, and the example set by its author in going ahead and, by a practical demonstration, showing not only the people in his own community, but all his fellow managers, just what gas can do compared with steam, is one eminently fit to be followed. It seems from many evidences that the gas managers in the newer communities of the West are outstripping their Eastern friends in the matter of advancing the development of the use of gas for purposes other than for illumination; and for this effort, in the right direction, they will undoubtedly be duly compensated.

The boldness of an engineer who should propose to his directors in an Eastern city of the size of Vincennes, Ind., to import a 17-horse power gas engine would, we fear, be looked upon as verging upon dreamland. But what was the result where it was ventured upon. A 17-horse power gas engine has satisfactorily done the work in a grain elevator which would have required a 25-horse power steam engine to accomplish the same results. The reason for this is that the former develops its full power at once and independently of outside accessories, while the latter is dependent on its boiler, fireman, etc., and cannot be relied upon to develop its full capacity at all times. The maximum consumption of gas was 18 cubic feet per horse power per hour. The estimated cost of gas engine, including first cost, setting up, repairs, running expenses of every kind for 25 years, is $16,000. The same items for steam engines amount to $54,000. Saving by gas engine in 25 years $38,000—the price of gas being $2 per thousand.

Considering the cost of operating alone, the gas engine cost per annum $600, the steam engine $2100—a saving of $1500 per annum, or $5 per day. The space occupied by the two engines is less for the gas than it is for the steam engines, even when the space occupied by boilers, etc., is left out of the question. The amount of grain handled in three months by the 17-horse power gas engine was 154,867 bushels, at a total expense of $170.60.

Here is a demonstration of economy that needs no comment, and with such figures as these there would seem to be very little cause for hesitation in recommending these machines for motive power. But for fear this might be deemed a special case in which, for some reason or other, the conditions were unusually favorable, other instances are cited, and among them is given the average results obtained from nine motors, the total horse power of which was 32. These motors averaged a little over 9 hours work each per day, and the average cost per horse pewer per engine was six and one third cents, and the average cost per horse power per hour was one and three-quarter cents.

These are but a few items selected from the results obtained to call the attention of gas managers to the salient points in the economy of gas motors. When we consider that makers of these same motors in England announce an average monthly delivery of over 180 engines, it would seem that the matter has long since passed the confines of experiment, and that our managers should look to it that they secure the additional amount of business that may result from their widespread introduction. These motors are as yet in their infancy it is true, and the constant demands made for motors to suit many different conditions will undoubtedly lead to improvements and modifications that will add much to their popularity. There are thousands of opportunities for their advantageous introduction in almost every community. In many places where steam power is not used, but where light intermittent power would be applied if it could be shown to be cheap, reliable and convenient, there is a chance for introducing these motors with mutual advantage to both the gas maker and consumer. The advances that may be made in gas stoves, joined to what will result from the increased application of gas motors, will put a different phase upon the gas industry of the country. A very slight increase in plant will enable almost any company to largely increase their business at a small additional expense for labor and coal in the retort house.

In these times when the electric light is working out for itself new and luxurious fields for illumination there is no better opportunity for increasing the usefulness of gas. Every motor employed in generating the currents for electric lights should be a gas motor. The steadiness, reliability, and economy of the gas engine renders it particularly adapted for this purpose, and there is no more appropriate use to which the gas motor could be applied than to generating light.

In closing we would urge upon our gas managers one other point, and that is that they should not only secure the introduction of the motors in every available place, but they should keep a careful record of the working

of each one, so far as consumption of gas is concerned, and also the amount of work done so far as it can be ascertained. These accumulated figures will be of value in arriving at accurate data for future use and for the further development of the business.

ELECTRIC STREET LIGHTING IN NEW YORK CITY.

Posts are being erected on Broadway from Fourteenth to Thirty-fourth streets for the purpose of making a demonstration of the practical effect of street lighting in this city by large electric lights. This work is being done at the expense of the electric light company, and it is expected that they will be in operation about New Years.

Electric Street Lighting in London.

The Commissioners of Sewers of the City of London have at length come to a decision on the proposed experimental lighting of the bridges and some of the leading thoroughfares of the city by electricity. On Tuesday last the Streets Committee, who have had the matter in hand since the beginning of July reported to the Court that they were disposed to recommend the acceptance of three separate tenders, from as many distinct electric lighting contractors, for the three districts into which the area to be lighted has been divided. District No. 1, comprising Blackfriars Bridge, New Bridge street, Ludgate Circus, Ludgate Hill, St. Paul's Churchyard, and Cheapside as far as King street, is allotted to the Anglo-American Electric Light Company (the Brush system), who undertake to supply 32 lamps, to be lit for twelve months, at a cost of £660, besides the sum of £750 required for providing, fixing, and subsequently removing the lamps and machinery, making the total cost for the twelve months trial £1410. The number of gas lamps replaced is about 150. There was a great difference in the four tenders received for this district, the one accepted being the lowest, and the Messrs. Siemens Bros. being the highest with an offer of 29 lamps for £3700. District No. 2 comprises Southwark Bridge, Queen Victoria street, Queen street, and Queen street Place, and falls to the lot of the Electric and Magnetic Company (the Jablochkoff system), who will supply 52 lamps for £1580, with a further allowance of £1350 for fixing and removing their plant and apparatus, or a total for the twelve months of £2930. The number of gas-lamps to be replaced in this district is 161. The successful tender was the highest of three received, Messrs. Compton & Co. and Messrs. Siemens Bros. being both lower, although there was not so much difference between the various tenders in this instance—a circumstance probably due to the fact that the number of lamps offered by the unsuccessful competitors was much less than that of the Jablochkoff candles. District No. 3 is the heart of the city, comprising London Bridge, Queen street (north end), Cheapside (eastern end), King street, Guildhall Yard, the Poultry, the open space in front of the Mansion House and the Royal Exchange, and King William street. Messrs. Siemens Bros. secure this, the head-quarters division, with the offer of 32 lamps, for which they require £2270, and £1450 for fixing and removing their apparatus, in all £3720 for the twelve months, the number of gas lamps replaced being 138. Thus we see that the total cost of this extensive "experiment" will be £8060 ($40,000.)

A descripttion of the various lamps and the proposed method of fixing them, accompanies the report, but need not be reproduced here, as none of the systems favored is particularly novel. The lamps are to be suspended at various heights above the roadway, ranging from 13 feet, as stated by the Anglo-American Company, to 70 or 80 feet in the case of the large lamps of Messrs. Siemens Bros. The methods of fixing the conductors to the lamps also differ in every case. The Anglo-American Company will carry their cables in graceful (?) festoons from post to post, and underground at crossings; and the Electric and Magnetic Company will also festoon their wires with the further improvement of crossing roads overhead at about 25 feet high, unless the Commissioners will allow £2000 extra to lay the lines beneath the roadways. Messrs. Siemens Bros., however, will lay their conductors underground, and in this they show a more practical appreciation of the requirements of the case; but it is to be feared they will find a heavy proportion of their allowance for fixing swallowed up in main-laying.

It is stated on the part of the Streets Committee, that the gross cost of the experiment will be *about four times the price now paid for gas lighting*, inclusive of the establishment expenses. We have heard something lately concerning the elasticity of city estimates, and it would possibly be instructive to see, after the year's trial is over, a fair balance struck, including every expense to which the city will have been put in consequence of this experiment. Still, a disproportion of four to one is enough to cause an indifferent observer to inquire why it is to be incurred—whether gas lighting has failed, and a great and sudden demand has arisen for electricity. For, be it remembered, there is no question of illuminating power considered, or if considered it does not find a place either in the report of the Committee, or in the speech of the gentleman who moved its adoption in the full Court. Not even by way of preamble is it stated that "whereas it is expedient to provide better means of lighting the thoroughfares within the city, especially after business hours; and whereas it has been demonstrated that the present method of lighting by gas is a failure; and whereas it has been proved that, on the grounds of constancy, reliability, cheerfulness, and economy, the electric light is infinitely superior to gas," etc. If something of this kind had been offered by way of explanation of the action of the Commissioners of Sewers, we should have known how to regard their proceedings; but as they give no reason at all, not even so much as was vouchsafed in the late controversy anent the Dragon of Temple Bar, we are constrained to believe that their motives are about equally rational in both cases, or that, from merciful consideration for the interests of gas shareholders, they decline to announce their convictions on the subject of the inefficiency of gas as a medium for lighting streets. It does not appear, however, that even all the members of the Commission are quite sure of the object of the experiment. Mr. Deputy Taylor is reported to have complimented the Streets Committee on the results of their labor in receiving the tenders, and in going about inspecting the various examples of electric lighting at present visible in the Metropolis; and probably feeling called upon to supply a meaning to the investigation, he concluded by expressing a hope that it would result in the public being supplied with an improved light at less cost than at present. Here at least we have a definite, though unofficial, object stated, and it is with quite a pang that we venture to observe that to begin by paying four times more than before is not the most obvious way of obtaining a cheaper light, to say nothing of the improvement in quality which is expected to follow. We fear the cheapness of the experiment must not be mentioned in view of the admitted figures, which, as we have seen, may hereafter be somewhat altered for the worse.

With regard to the improvement in th elighting there is more to be said. If the Streets Committee were to tax their memories but a littte, they could scarcely fail to remember a time, not so very long ago, when Queen Victoria street was made exceedingly brilliant, without entailing on the City the extra outlay of one shilling; the Waterloo Bridge road was also illuminated in a very striking manner indeed, and so was Waterloo Place. Even now, if the peripatetic Committee had really cared to see how streets and open spaces can be illuminated, it is not a very "far cry" to Birmingham where they would have been able to see again what gas lighting is capable of effecting, when freely and judiciously used. Or, if we mistake not, the Committee actually had an offer from a well-known gas apparatus manufacturer—simultaneously with the tenders of the contractors for electric lighting—to light any line of thoroughfare that might be selected, with the most improved form of powerful street lamps, calculated to give an equal average amount of light at a lower cost than any known system of electric lighting, in order that the two methods of illumination might be witnessed in operation together, and a comparison made between them as nearly as might be on equal terms. But this is travelling beyond the record. The Commission are not so much anxious for light as for experimental research; and they will doubtless succeed in satisfying themselves, as usual, whatever may be thought of their pet project by the public. The City authorities have lately shown that public opinion has but little weight with them, so they must be allowed to follow their bent without reference to anything but their own convictions. Fortunately, however, these convictions are not always respected to any great degree outside the sphere of their own immediate influence.

We have another word to add on this matter. A member of the Commission had the temerity to suggest that the accepted contractors should be made to give security for the due performance of their contracts. For this he was promptly snubbed, and thereupon the incident terminated. It is by no means self-evident, however, that his advice was needless or inopportune. The Commissioners are about to hand over long lines of the busiest and most important streets in the world to a group of experimenters who may at any time find themselves unable to fulfil their engagements, or may become involved in unlooked for circumstances which may compel them to suspend operations altogether or for a time. Our Parisian contemporary, the *Journal des Usines a Gaz*, publishes monthly a list of the number of extinctions suffered by the electric light in Paris, which are said to recur at frequent intervals, no less than *thirty-one* interruptions being recorded for the month of September *in two districts alone*. If this effect should occur occasionally in the City, the warning of Mr. Boor will appear prophetic to those who remember it.

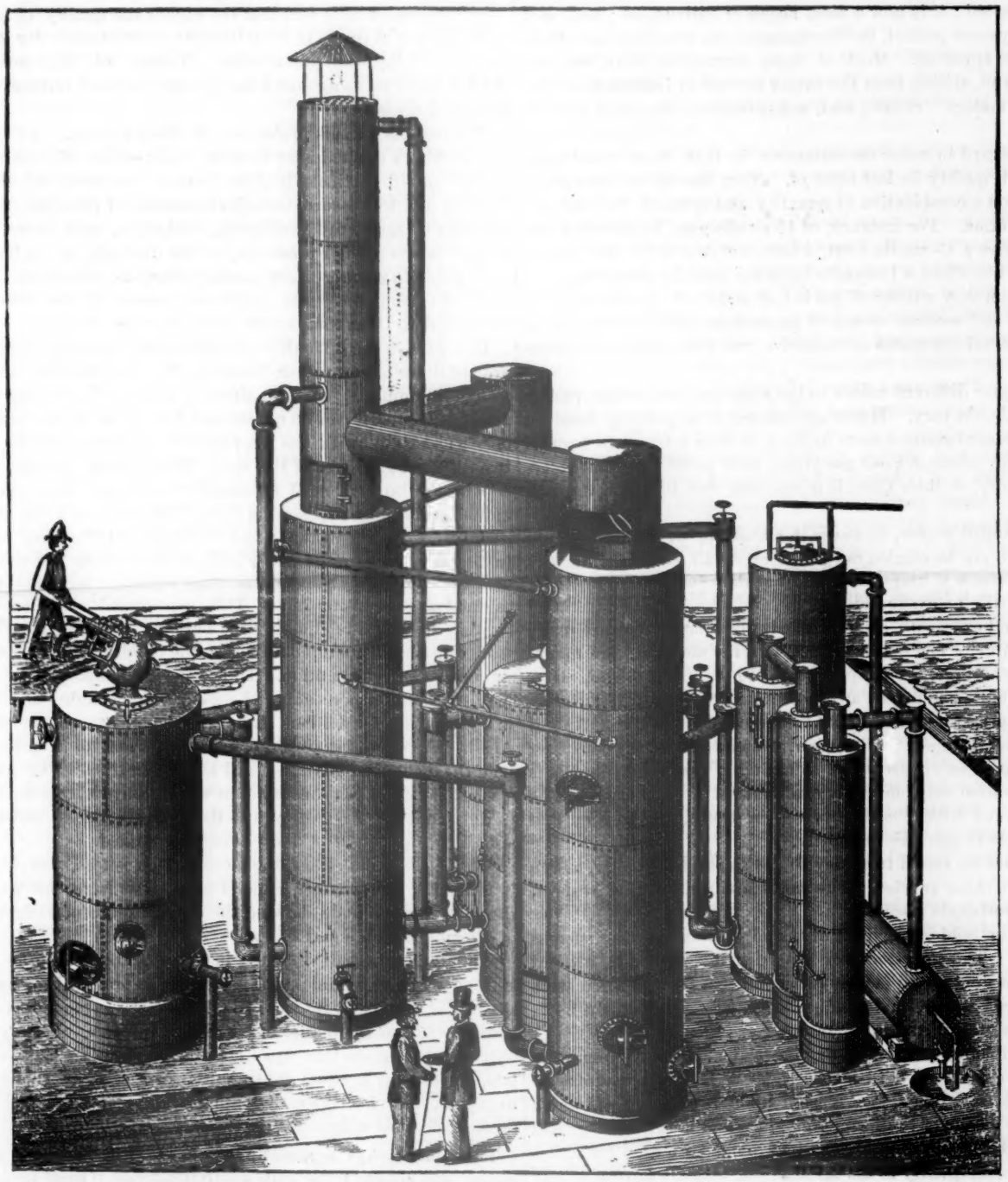
The commencement of the experiment is to date from the first of February next instead of the beginning of the present month as originally contemplated. The Commissioners are to be pitied on account of their failure to have their great project ready before the last Lord Mayor's Show, for it will probably have lost all novelty before next November, when we may perhaps expect to see a portable electric light dragged on a van to Westminster and back, to symbolize what will perhaps be considered, at Guildhall, one of the most brilliant results of City enterprise.—London *Journal of Gas Lighting*, Nov. 23

The Lowe Process.

OFFICE OF THE NATIONAL GAS COMPANY,
430 WALNUT ST., PHILA., PA., Dec. 11, 1880.

To the Editor of the AMERICAN GAS LIGHT JOURNAL:

Dear Sir—Since the first introduction of my process of gas making in 1874 (the entire success of which, I believe, is undisputed by all who are using it), about 50 cities and towns in the United States and Canada have adopted its use entirely, and are saving very largely thereby. In some instances, from 700,000 to as high as 1,200,000 cubic feet daily are produced. In the above-named process anthracite coal, water, and oil are alone employed. Thinking that your readers might be interested in knowing that I have made valuable improvements in gas making since my patents were first taken out, I send you a cut representing the apparatus of the new "Lowe Gas Process of 1880," which apparatus is adapted for the use of *bituminous coal* in making gas, although any kind of fuel can be used equally well, including anthracite coal, wood, asphaltum, etc. This new process is continuous in its operation, and produces a steady flow of gas without intermission. It will make illuminating gas of high candle power, or non-illuminating gas for heating purposes. A single set of apparatus under this new process can be erected on a ground space of less than 50 feet square, capable of producing from 2 to 3 million cubic feet daily of illuminating gas, or 10 million cubic feet of non-illuminating water gas for heating purposes. This apparatus can be worked to the greatest advantage by alternately making both kinds of gas, whereby the volatile illuminant from bituminous coal can be extracted and deposited in a gasholder for illuminating purposes, while the coke in its incandescent state, without being removed from the generator, is employed in the decomposition of water, producing the best heating material known. My experiments during the past 8 years, in the production and use of water gas for general heating and cooking purposes, I think have convinced all who have seen them that this branch of the gas business will very soon exceed in magnitude anything ever done in illuminating gas. To those who desire it I am prepared to show that at 15 cents per 1,000 cubic feet to consumers, far more clear profit can be realized on the investment necessary for its production than was ever made in the same town on illuminating gas in its best days. To those companies who have two lines of street mains, very little additional expense would be necessary, while competing companies would do well to unite their interests and carry on both branches of the gas business. The National Gas Company, represented by me, have commodious and well-appointed shops, established expressly for building all machinery connected with the processes, and are prepared to grant licenses, establish agencies, and erect works on the most reasonable terms throughout the United States and Canadas, under the "Lowe Process of 1880." They also license and build works under the "Lowe Process of 1875" (alluded to in the first part of this letter), for a large portion of the United States not yet licensed to other parties.



"Lowe Gas Process of 1880."

Information concerning all of which will be given to those desiring it.

Very respectfully,

T. S. C. LOWE,
Treasurer.

—*Adv.*

[Official Report.—Continued from page 252.]

Eighth Annual Meeting of the American Gas Light Association.

Held at Chicago, Ill., October 13, 14, and 15, 1880.

Morning Session—Oct. 14.

The Secretary then read a paper by Mr. Edgerton entitled

selling gas on an illuminating basis.

It is difficult to speak of gases quantitatively in any other way than by the cubic measure; hence the selection of cubic measure as a basis of price and sale. The invention and introduction of the gas meter as such a measure were indeed steps of vast importance in the advancement of gas lighting The manufacture of gas could have made but slow progress without it. The meter has been perfected; it is now a most accurate instrument; but, as it became mechanically more perfect, the anomalies of the cubic foot as a basis of price became more apparent. Most of these anomalies, it is true, are only apparent, not true, arising from the rather excusable ignorance of consumers in regard to meters. Others, and, unfortunately, the most serious, are founded on fact.

The difficulty in regard to meter measurement is that it is based upon quantity alone, and quality is lost sight of. Now, the value of gas is dependent not only upon a combination of quantity and quality, but they are exactly convertible terms. For instance, of 15-candle gas, 5 cubic feet per hour is required to give a 15-candle light, whereas of 30-candle gas but 2½ cubic feet is required to afford a 15-candle light the same length of time.

There is good reason why quality of gas is lost sight of, particularly by the buyer—no ready and accurate means of ascertaining the varying quality of gas exists. The usual apparatus is expensive, and the standard of comparison variable.

Different burners give different values to the same gas, and as the quality varies, the burners should vary. Hence gas testing is apparently involved in chaos, and some manufacturers seem to think it their interest to keep it there, because, as they contend, poor gas yields most profit to the manufacturer, and consequently, in their view, is in the long run best for the consumer.

The only well-grounded reason, however, for a dislike of quality tests is the fear that they will not be carried out; and, above all, the real difficulty of maintaining at all times a uniform standard at the consumer's burner—a difficulty that can hardly be exaggerated.

With coal alone, and even with cannel added, the fluctuations are really great and uncontrollable. The quality varies with the material, the manufacture, the period of storage, the temperature and pressure of the air. How to meet all these difficulties is indeed a troublesome problem, for certainly the temperature and pressure of the air are things not controllable. And, if all these difficulties can be made to disappear, the inability of the consumer to ascertain quality puts an apparent and to basing a price thereon. It is surely a poor trade, where only one party can know of a certainty what he is doing. Therefore any quality basis involves, in reason, the position that the buyer shall be able to ascertain it rightly.

Neither can the price be varied from day to day to suit the quality, as can be done in the sale of other articles. The manufacturer, in this respect, seems to be in an unfortunate position.

Legislation has taken hold of the difficulty, and with about the success we might anticipate. The manufacturer has been discommoded, without any benefit to the consumer. In fact, it is the old story—legislation steps in to adjust differences between buyer and seller, and levies tribute on both, for the benefit of lawyers and supernumeraries.

It is true, gas manufacture in this country has had comparative immunity from the attacks of law makers—not because there is less reason or excuse for interference, however. When gas is sold upon a correct basis which shall embrace quality as one of the factors of value as well as quantity, and when an ordinarily intelligent consumer can be provided a means for ascertaining both quantity and quality to his satisfaction, without having to rely on the certificates of inspectors, then, in fact, the business will have a right to be independent of the interference of special laws, and a just public sentiment will not require nor even countenance them.

Having mentioned many of the difficulties in the way of establishing a quality basis for prices—made it appear, perhaps, quite impossible—I propose to put forward a plan which, in the present state of the science of gas manufacture, I believe will meet and overcome all difficulties. I hope it will receive the severest of criticism, that not only objections founded on reason will be urged, but the still greater array founded on prejudice, on conservatism, so called.

Before going into the description, it will be best to clear away in advance some of the apparent difficulties, as well as to state a few further reasons in favor of a quality basis. It will not be necessary to argue that a quality basis alone is favorable to plans for extracting the greatest quantity from any given material, and is therefore a premium on a low quality gas, because in all the range of gas-producing materials the greater cubic measure the yield of gas, the lower the quality and the faster it will consume, either for a given light or with a given pressure. It is true that with every gas making material there is a point of yield beyond which the illuminating effect is diminished in a ratio greater than the yield is increased. A quantity basis not only tempts us continually beyond this point, but leads to an excessive degree of ingenuity to deceive ourselves as to its proper location, as, for instance, in the employment of a burner for quality tests, which enhances poor gas and depreciates relatively better qualities of gas. A quality basis, on the contrary, will lead us in the direction of better gas, and in that direction lie the greatest economies. If that is not a true proposition, poor gas in England and Scotland would be selling as cheaply, light considered, as rich gas, which is not the case, and never has been.

It is an undeniable fact that the higher the quality of gas, the more advantageously it burns in such burners as consumers for other reasons than economy of light are prone to use. I speak of high pressure batwing or fishtail burners, as against lower pressure argand burners or checked batwing and fishtails.

The reasons for this preference are plain enough. An argand burner has the drawback of a chimney to clean, and besides will not stand the slightest current of air, particularly if the burner is economical of gas. Flat flame burners of low pressure, though economical of poor gas, compared with high pressure on same, are vacillating, flickering, and prone to smoke. Flat flame burners at high pressures, on the contrary, give a fixed flame, and are little liable to smoke. Low pressure burners have been the sole stock in trade of venders for years, and yet comparatively few remain in use, notwithstanding their comparative economy with poor gas.

In regard to the difficulties of testing gas, agreeing upon methods, standards of illuminating power, burners, etc., the troubles all lie in giving a proper illuminating value to different kinds or fluctuating qualities of gas. I do not believe it can be questioned that it is in the power of almost any one to ascertain, with the simplest of apparatus and instruction, whether two different gases are of the same illuminating quality. No question of standard or burners need necessarily intervene. The old durability test, applied with proper apparatus and a little care, will do the business completely. Take, for instance, one of Sugg's "D" argand burners, and, adjusting it to an accurate meter and governor, turn on the gas to a given height of flame (say 3 inches, as Sugg advises), and note for a given time the rate of gas consumption. This experiment often repeated, each time turning down and readjusting the burners, will demonstrate the accuracy with which such a simple matter as the height of flame can be used to show uniformity of consumption. Dilute the gas employed in this experiment with the smallest percentage of a gas giving no light, and the consumption in a given time for a 3-inch flame will change—more gas will be required. Again, take a number of single jets, turn them to a uniform height, and note the amount of gas consumed in a given time. The gas remaining the same, the rate of gas consumption will be surprisingly uniform. A change in the quality of the gas, even to the slightest extent, will show in the consumption, the height of flame being maintained.

As the gas grows richer, the consumption is less, and *vice versa*. Sugg's illuminating power meter is based upon these facts, but Sugg has gone further, and made a scale showing the quality corresponding to different rates of consumption in equal times.

We might anticipate difficulty in adapting one scale to different gases, and indeed there is, unless the difference is provided for by an alteration in the height of flame. Sugg's scale, however, corresponds very closely with results obtained by the use of his argand burners. For my purpose, I wish only to substantiate that equal heights of flame in Sugg's argands, and in jets, correspond to equal consumption of gas when the gas is uniformly luminous, and *vice versa*, that equal heights and unequal consumption indicate difference of luminosity.

The difficulties of manufacturing a uniform standard have been mentioned, and appear to be quite insurmountable, if great uniformity is needed. Suppose, however, a gasholder filled with gas below a certain standard, another with gas above the standard, it seems not at all impossible to add of the rich to the poor until the standard is obtained. I am aware that even in the larger works at times during the manufacture there are fluctuations, and it would be difficult, if not impossible, to gauge the admission of a rich gas, even of uniform quality, to produce a uniform result. But to a holder containing poor gas, a uniformly rich gas can be added until a certain standard is obtained.

Having cleared away some of the difficulties, I will now describe my plan of making a uniform gas and selling it on an illuminating basis. There is nothing startlingly new in it; if there was, I should not propose it with much confidence. In fact, it is based essentially upon the well-known, the tried, and approved.

Having determined upon the kind of gas to be made, I proceed as follows,

and for greater clearness of illustration I will carry out a supposed case. I have made a number of tests of the Municipal gas in New York, and will take that as a basis to serve for illustration.

I first obtain a 14-candle flame in one of Sugg's new argands, preferably his "C" burner. Sugg gives in a table the height of flame required in his "C" burner to afford a 14-candle light, but as his statement is based upon coal gas, it does not quite hold good with Municipal; hence it will be necessary to make a series of tests to ascertain with accuracy the exact height of flame necessary to give a 14-candle light with the gas in question. It is not necessary to note the exact consumption of gas required to maintain the flame, except as a matter of easy control; in fact, a meter on the burner can be dispensed with.

Having obtained a 14-candle flame, I place it at a convenient distance from a photometric screen, and at an equal distance, but upon the opposite side of the screen, is placed an ordinary burner of the excavated batwing variety, with the flat of the flame turned at an angle of 45 degrees with the line between the two lights. Gas is turned on to the ordinary burner until an equal light is obtained upon the screen. In regard to the flat flame burner, it should be chosen of such size as to afford approximately a 14-candle flame, with a pressure of 4 to 5 tenths at the point of ignition. In the case of Municipal gas, it should be a 4-foot excavated lava-tip batwing. It would be found to consume 2 6 10ths cubic feet of gas to afford a 14-candle flame. As this point is a matter of importance, which has to be ascertained once for all, a series of tests must be taken. The batwing should be turned off, and again on, to a point of equal light many times; at each operation ascertaining by an accurate meter the hourly rate of consumption. A mean hourly rate having been ascertained, the third step is to find the height of flame in a suitable Sugg argand which a rate of consumption equal to that of the 14-candle consumer's burner will give. It will be best for this purpose to use an argand a size smaller than the one previously employed to get a 14-candle flame—say burner "B" of Sugg's series. As a check, it will be well to supply a cluster of simple jets, say 3 to 5 in number, with an amount of gas equal to that required for the 14-candle flame burner, and to note the height of the jets, the height of all being equalized. The two argand burners are to be marked with a ring on the chimney of each—that on the larger, "C," indicating the height of flame required to give a 14-candle light; the smaller one, "B," the height of flame afforded by a rate of consumption equal to that of the consumer's batwing when giving a 14-candle jet.

The burner "B" thus marked I call the "consumer's test burner." Attached to a governor, it can be used by the consumer to test the registration of his gas meter, on a plan which will be presently described.

The manufacture of a uniform gas by the Municipal method is by no means a difficult task.

We have now an argand burner "C" marked with the height of flame required to make a standard light. We have also a rate of consumption by the meter, corresponding to a given height of flame. In the manufacture we have to see to it that for the given height of flame a uniform consumption rate is maintained from day to day. I believe the simplest way to do this is on a plan first introduced in Waco, Texas, last year. The argand burner "B" is adapted to an accurate meter and governor, and the standard gas is turned on to a convenient height of flame short of smoking or tailing. The consumption rate having been ascertained, the motion of the gas hand is geared up or down, as the case may be, so that the gas hand of the experimental meter shall revolve in exactly one minute. The standard quality of gas is then turned on until the hands of the minute clock, and the gas hand revolve exactly together for a number of minutes. The height of flame is then marked on the chimney.

For convenience, it will be best to have the clock hand and meter hand run concentric, as in Mr. Sugg's experimental meter. It is plain, then, that with the height of flame as marked, the hands of this meter and clock will run together, with gas of the proper standard; as the standard varies, the gas hand will gain or lose on the clock.

My plan is to alter the richness of the gas from time to time, by altering the feed of naphtha, so as to keep the hands revolving together. To do this most effectually in a large works, the test meter should be located to take the passing gas as near the retorts as possible, and to that end should have a small purifying apparatus connected with it. The changes will thus be more quickly noticeable. The difference in relative purification may cause the test to vary slightly from the standard, and to note this difference if desired, a duplicate may be made to run on the gas coming from the large meter.

There is no difficulty in adjusting the feed of naphtha to produce a given richness of gas; in fact, the feed can be far more delicately regulated, than we can obtain indications whereby to regulate it.

Being in a position to produce a practically uniform gas, there is really no great reason why it cannot be sold upon a quality basis. I will shortly describe the means I have found most effectual to accomplish it. The price of gas light is stated at a definite price per hour for a 14-candle light. If it is desired to make the new standard easily comparable with coal gas prices, it is only necessary to remember that a 14-candle flame requires fully a consumption rate of 5 cubic feet per hour, in a moderately checked burner. This burner will give a flame somewhat lacking in steadiness, and will approximate the point of smoking; but an economical burner for coal gas, and yet one desirable in other respects, is very hard to find. A compromise between economy and steadiness of flame will have to be made.

The following table will serve to show the cost per hour for a 14-candle flame corresponding to various prices for good coal gas.

Coal gas,	at	$1.00	per	M.,	affords	a light of 14 candles, for	½	ct. per hour.
"	"	1.50	"	"	"	"	¾	"
"	"	2.00	"	"	"	"	1	"
"	"	2.50	"	"	"	"	1¼	"
"	"	3.00	"	"	"	"	1½	"
"	"	3.50	"	"	"	"	1¾	"
"	"	4.00	"	"	"	"	2	"
"	"	4.50	"	"	"	"	2¼	"
"	"	5.00	"	"	"	"	2½	"

And so on, adding one-quarter of one cent per hour for each 50 cents per thousand cubic feet.

The above comparison is based upon really good coal gas, such as made at Boston and a few other points I could name. I believe it is based upon a quality above the average.

In the case which I have been following, it is evident that the meters would have to be so arranged as to register 1 cent per hour for each 2 6-10 cubic feet of gas, to put the price equal to coal gas at $2 per thousand. This would be very easy to do. The above ratio is based upon Municipal gas, as actually found; a slight increase of naphtha would bring the rate of consumption to 2½ cubic feet, which would be a better ratio. It is obvious that the meter registration can be arranged in divers ways to accomplish my purpose. For instance, it might be made to register hours consumption of a 14-candle power. The dial in this case would be in standard 14 candle hours.

Each hour registered would indicate a light of 14 candles for one hour where the consumer's standard burner is used. If a larger burner is used, a slightly greater proportional light would be obtaind; if smaller, slightly less. Rich gases, however, give but slight variations in the ratio of light to gas consumed, for varying consumption.

If a "standard hour meter" is used, the hours indicated have to be multiplied by the price, just the same as with the cubic foot meter, with this difference—that a standand hour light is a definite amount. Again, the meter may be made to register "candle feet." I borrow this term from Mr. Farmer, only giving an altered meaning to it.

Five candle feet give an hour's 14-candle light. For a 14-candle gas, 5 candle feet and 5 cubic feet would measure the same; for any other quality they would differ in cubic measure, but be the same in light giving power. One thousand candle feet would always equal 1000 cubic feet of coal gas in light giving properties. Between candle feet and cubic feet would be this difference: 5 cubic feet *may* give a light of 14 candles for an hour; 5 candle feet *must* do it. The candle feet bills would be made out as usual—say, "1000 candle feet, at $2 per 1000," means that the consumer has had 200 hours' consumption of a 14-candle light.

I have spoken of this programme as a proposed plan. It has, however, been carried out for a number of years, and is working more or less successfully in about 40 towns. The methods have been perfected from time to time. The last improvement has been to put the consumer in possession of a certain and accurate test, as above described.* To bring the consumer into friendly understanding with the company, and make him their advocate and the advocate of the much abused gas meter, is indeed a matter of congratulation, if it can be done. The method of doing that is, in my opinion, to furnish him a means of satisfying himself of the general accuracy of meters, and the uniformity of light. Very few consumers are aware of the present accuracy of meter measurement, because they have no independent means of establishing it.

Now come the objections to the system. The trial already had has developed all the objections likely to arise on the part of the consumer, and in a far stronger light than they can now be viewed. When the system was first introduced it was more difficult to manufacture a uniform standard, for though no new principles of testing have been applied, old ones have been modified and perfected to best suit the emergency. The jet photometer did not answer to rate naphtha gas. We had to go back to the principle of the old duration test of Dr. Fyfe; but instead of using his single jet, it is better to use an assemblage or one of Sugg's burners. Then we had no means at the start to make the consumer his own judge of quality. He had to rely on comparatively crude tests, but, notwithstanding, I heard of but few complaints from the consumer. He was generally satisfied with the state-

* The meter was patented, but no extra charge was made for it on that score. It is my intention to patent the above, in connection with the standard light for proving.

ment that such and such a burner gave a fourteen candle light. This was no doubt owing to the fact that great pains were taken to keep up to or above the standard promise.

The first town in which I set the meters, Sunbury, Pa., gave to the official test 39 hours' light for 35 cents. The rate was to have been 1 cent per hour for a 14-candle light.

I attach hereto a copy of the test made at Waco, Texas, during July and August, 1879, showing the degree of uniformity that can be expected. After each filling of the holder at Waco, a test meter, provided with a burner such as described, is set in motion, the clock hand and gas hand together. At the end of ten minutes the fraction of a cubic foot of gas consumed is entered in the accounts. From that is deduced the time required to burn one cubic foot of gas, giving a continuous 14-candle flame. The report shows, during July, a mean of 39.01 minutes' duration for 1 cubic foot, highest, 40 minutes; lowest, 38.6 minutes; highest above the mean, 2½ per cent.; lowest below the mean, 1 per cent. August shows: highest, 40 minutes; lowest, 38.6; mean, 39.24;—thus differing but 57-100ths of 1 per cent. only from the previous month. When it is remembered that one cubic foot supplied in an argand burner a light of 14 candles for a period of 39.24 minutes, the richness of the gas seems quite extraordinary.

So far as I am aware, no objection has been made public against the selling of gas upon an illuminating basis, unless, indeed, the report of the committee from Waterbury, Conn., published in the American Gas Light Journal, can be taken as a critiscism. In order to answer it, I will first state that a committee from Waterbury, had been investigating a new process of gas making, in operation at Rhinebeck, N. Y. They there found the bills were registered by a dollar and cent meter. Comparing a number of the bills so registered with statements of consumers as to hours burning, number of burners, etc., the committee found great discrepancies in registration.

Though a similar method of comparison, if carried out elsewhere, would undoubtedly show great discrepancies, from the fact that few gas consumers can accurately state the number of burners, hours lighted, size of burner, or mean pressure of gas; yet from the report it is plainly apparent that the consumers at Rhinebeck had no means provided for them to ascertain the general accuracy of their meters. In fact, if the committee is correct, the Rhinebeck Gas Company sets a dollar and cent meter, registering at some unknown sum per cubic foot, instead of setting a cubic foot meter to register upon an unknown quality of gas; hence Rhinebeck is virtually supplied upon the cubic foot no quality stipulation basis.

I see no difference between the dollar and cent basis at Rhinebeck and the ordinary cubic foot basis elsewhere. They both deal in unknown values. The price of gas, to correspond with its value, must be based upon quantity and quality combined. In the present state of the science of gas making, we have a choice of materials which range from 1 to 5 in illuminating value for a given bulk. Hence quality has become, if possible, a greater factor than quantity. Yet prices are based upon quantity alone. To apply this to the Rhinebeck case, had the dollar and cent meter been constructed to register the gas as manufactured there, in exact correspondence with stipulated light, there would have been no good cause of complaint. On the bill as presented to the consumer should have been some such words as follows: "This bill is registered by meter in dollars and cents, at the rate of 1 cent per hour for a 14-candle light." And if, in addition to that stipulation, the consumers were furnished with easy and accurate means for ascertaining that light, and comparing it with the registration of the meter, it seems to me that not one reasonable consumer in Rhinebeck would have complained of the system.

At Coney Island the dollar and cent meter was used by the Kings County Gas Light Company, and some dissatisfaction was expressed by one of the largest consumers. As in the case at Rhinebeck, there was no clear understanding at Coney Island about price. The bills were made out at $2.50 per thousand, just the same as if a cubic foot meter was used. I believe the meters registered in dollars and cents on a basis of $12.50 per thousand. This price was assumed to be equal to coal gas at $2.50.

The registration of the meters in dollars and cents was divided by 2.50, and the bill made out for a number of cubic feet to correspond to that. This plan was all wrong. The price should have been stated at so much per hour for a 14-candle light. In the case of Coney Island it would have been 1¼ cents. Pains should have been taken to show consumers the accuracy of the registration as compared with a given number of hours consumption of a standard burner.

The managers at Coney Island appeared to have an entire misapprehension as to the use of the dollar and cent meter. They seemed to think it necessary simply to get meters of a given rate, and set them without any understanding with the consumer, or without furnishing him any means of satisfying himself. Nor was there any apparatus, nor test, whereby to maintain an unvarying and standard quality of gas. The quality was judged simply by a flat flame test burner. Now, my experience is, that rich gas can undergo a great change in quality, and yet make a good flame.

This arises from the fact that as the gas lowers in quality, more of it is burned, thus frequently improving the *appearance* of a rich gas flame, while the quality is far from the standard. I found the gas by test at Coney Island to be at one time 21 per cent. below the standard, but this was owing to the fact that the apparatus was not adapted to making a gas of 70-candle standard sufficiently clear from smoke. This was afterward remedied, in great part.

In conclusion, I wish to submit the following propositions for discussion, believing that I can substantiate my views of the advisability of manufacturing and selling gas strictly upon an illuminating basis:

1. By a proper use of naphtha or mineral oils gas can be made either pure or mixed, of great uniformity, in regard to illuminating power.
2. To attain this uniformity, a modification of the durability test is most useful, and without a *continuous* test, somewhat as described above, no great uniformity ought to be anticipated.
3. Owing to the great range in quality of gas as manufactured at present, it will be conducive to the interests of the manufacturer, as well as the consumer, to sell gas upon an illuminating basis.

Mr. Forstall—I move that a vote of thanks be tendered Mr. Edgerton for that paper. (Carried).

Discussion on Mr. Edgerton's Paper.

Mr. Forstall—The question opened by Mr. Edgerton is a very important one. It is a source of regret that he is not here in person to answer objections that naturally arise. There is no doubt that, theoretically, he is right. We should sell our gas according to its quality, just as any other manufacturer sells his goods. If I sell 30-candle gas by the thousand cubic feet, and sell 15-candle gas in the same way, at the same price, it seems absurd on the face of it. The difficulty in applying the theory to practice in this case is simply a difficulty of detail. If we were starting gas works in a new country that had never had anything to do with meters or cubic feet, it is very likely that our first idea would be to sell our gas according to its illuminating power. But a great many companies in this country are bound by statute to sell gas by cubic feet. That is the case in New Orleans. We are entitled to receive so much per thousand cubic feet. We can afford to give 15 candle gas, we will suppose, for the price we are entitled to charge. If we should make thirty candle gas we cannot charge any more. The meters are rated at so many thousand cubic feet. These considerations would, at the outset, prevent Mr. Edgerton's plan from being carried out in New Orleans.

Mr. Somerville—I could not get the exact drift of the paper in some particulars, but I thought, in listening to it, that he advocated a meter that would satisfy the consumer. If that is so, I think it is certainly a very desirable thing.

Mr. Helme—I remember that, some years ago, Mr. Edgerton patented a dollar and cent meter that he refers to. He had a patent for a meter that, instead of having cubic feet on the dial, had dollars and cents, and a good many of them were introduced. But some consumers, thinking their bills were no less than they were when they used a cubic feet meter, got to questioning the thing a little too closely. They were like the fellow in Washington who had a double register meter at the time when they were being introduced there. He thought his bills were quite as high, if not a little higher, than they were before under the old system, although it cost a good deal less per thousand. He took the meter out one morning and tested it, and for every thousand feet they charged for, the meter only registered five hundred feet. He put it back again, and, after a while, the bill came around and he would not pay it. They finally threatened to sue. He said to them, "I am ready for that. I have been figuring it out, and I find that you owe me so much money. Your meter only registers five hundred feet for every thousand feet you charge for; and if you do not pay me I will sue you."

That was an end to the double register in that town. Mr. Edgerton's dollar and cent meter is constructed upon a theory which may, perhaps, be all right if it can be carried out practically. If he makes a uniformly high quality of gas, and puts on small burners, he certainly gets a good light for a small amount of gas. But the difficulty comes in there, as it does in most places, that small burners close up, and the gas fitters are always ready to put on new burners whenever you want them to. The result is that people become dissatisfied in places where they have gone on the basis that a high quality of gas should be sold for a correspondingly increased price. Although the meters were all rated right, yet when they came to figure upon it in some places, it was found that they varied a good deal. In some cases they registered 10,000, in others 7,500, and so on. I will not vouch for the figures exactly, but I heard of two meters where one of them registered 10,000 and the other 15,000. People began to think that there was a good deal of uncertainty on the part of gas companies, and they will think they

have been cheated unless you have printed on the back of your bills full instructions as to how the meters should be read, and how they can themselves tell whether they are using a large or a small amount of gas. But even if you educate them up to that point they will forget it before the next bill comes around. The result is that I do not see any better way than to keep on with the cubic feet meter.

Mr. Starr—I presume it might be well to have a good meter to register the quality of the gas; but I cannot see why a dollar and cent meter should be any better than any other, because you have got to use the feet measure. It is to the interest of all gas companies to make good gas. That will give more satisfaction than any meter that registers dollars and cents or otherwise. I think the difficulty would be to find something that will give the test quality of the gas in the meter.

Mr. Forstall—It never occurred to me that the Association, as a body, was expected to endorse every opinion or position taken by the writer of every paper that is read before us. I hardly think Mr. Helme can maintain that position. We are here as gas men—coal gas men, oil gas men, and water gas men. I think, clearly, that every man should have the right on the platform or on the floor of the Association to state what his opinion is. I do not think the Association is bound by any opinion, whether we have discussed it or not. It is merely the expression of a man's individual opinion. If we choke off every water gas paper or oil gas paper that is presented before us, we shall soon have the unenviable reputation of keeping them out of our discussions, instead of giving them an opportunity of expressing their views, and then demonstrating their error or their exaggeration. I do not think any of us desire to occupy any such position as that.

Mr. Helme—If I am understood as wishing to choke off that paper, or any other paper on water gas or any other subject pertaining to our business, I am sorry for it, because I have no desire in the world to do such a thing. I believe in the fullest liberty of discussion, and the expression of individual opinion, and I must have been unfortunate in the expression of my views if I have given, by anything I have said here, a different impression.

PLACE OF NEXT ANNUAL MEETING.

Mr. Neal—I will state that the committee appointed to determine upon a place for the next meeting unanimously recommend that the next annual meeting of the Association be held in Boston.

On motion of the Secretary, the recommendation of the committee was adopted, and the committee discharged with thanks.

The Association then took a recess until 2 o'clock P.M.

AFTERNOON SESSION.—OCTOBER 14TH.

The Association met at 2 P.M., pursuant to adjournment.

The President—Having decided to hold our next Annual Meeting at Boston, it becomes necessary to appoint a Committee of Arrangements to prepare for it. The following gentlemen will constitute the Committee:

Malcolm S. Greenough, of Boston, Mass.; George B. Neal, of Boston, Mass.; A. B. Slater, of Providence, R. I.; O. E. Cushing, of Lowell, Mass.; J. H. Rollins, of Worcester, Mass., and the Secretary.

Mr. Pearson, of Toronto, Canada, then read a paper entitled

THE WORKING OF THE LOWE PROCESS AT TORONTO.

This paper is presented in compliance with a request conveyed in a resolution passed by this Association at its last meeting. Had I merely consulted my own inclinations, I should have respectfully declined this request; but, believing that it is due to the Association that they should have fuller and more complete information upon the subject than I was able to present in my last paper, and that the interests of gas making would be promoted thereby, I have waived my personal feelings.

I wish it to be understood that I do not appear as an advocate of the Lowe process, but that it is simply my intention to present facts regarding it of which I am cognizant, and leave it to the members of the Association to draw their own conclusions therefrom; and in doing this I shall endeavor as frankly to mention what I believe to be its disadvantages as well as its advantages, but it is certainly a fact that I am still as well satisfied of the superiority of the process as a whole over the old process as I was last year.

It will not be necessary for me to give a description of the process, or the method of working it, as I did so in my last paper, and most of the members of the Association are doubtless well acquainted with it, and those who are not can easily obtain the information elsewhere. I shall therefore, without further introduction, enter upon the discussion of those points which I believe will be of interest to the meeting as a whole.

Gas by the Lowe process was first make in Toronto on February 9, 1879, with two sets of apparatus. Between then and September 30, 1879 (up to which time I had reported), 26,641,000 cubic feet had been manufactured. Two more sets went into operation on December 19; two more on January 3, and in August last a seventh set was completed.

Up to February 17, the process was worked in conjunction with coal gas works; since that time gas has been made by the Lowe process alone. In referring to the general working of the process, and in giving items of wear and tear, I shall go back to the time of its introduction; but I shall give the items of the manufacturing statement from the date the gas was made by the process alone up to September last, the end of our financial year. This statement I now give below:

Statement of Gas Manufactured by the Lowe Process at the Works of the Consumers' Gas Co., Toronto, from Feb. 17 to Sept. 30, 1880.

Number of charges	14,865
Average production per charge	4,690
Total production, M cubic feet	69,729
Average material used per M feet—	
In generators:	
Crude petroleum, gallons	4.29
Anthracite coal, pounds	59
In boilers:	
Anthracite coal, pounds	4
Bituminous coal, pounds	7
Average gas purified per bushel lime, M feet	9,709
Purification—	
Material, average cost per M feet, cents	2.16
Labor, average cost per M feet, cents	1.43
Superintendence and labor—	
Gas making, including salary of superintendent and wages of 2 foremen, stokers, engineers, and coal wheelers; cost per M feet, cents	7.65

The largest production per diem of 12 hous from 4 sets was 270,000 cubic feet; 6 sets, 362,000 cubic feet. The largest production per diem of 24 hours from 6 sets was 681,000 cubic feet.

Between April 18 and September 21 all the gas was made in the daytime except on special occasions, and none was made on 20 Sundays.

Three stokers are sufficient to work 4 sets, and on emergency 5; and four stokers can work 6 sets, and on an emergency 7, each capable of producing 100,000 cubic feet in 24 hours.

The men at the purifiers are also employed at other work, though their whole time is charged to purification.

The cost per thousand for superintendence and labor will of course be considerably lower during the winter months, when a larger quantity of gas is made (with us, about 75 per cent more in the six months commencing October 1 than in the six preceding months), and only the same superintendence and same number of engineers and men at purifiers being required.

Steamboat size coal has been found the best to use, as allowing sufficient space for the steam to pass through during the process of gas making.

The Canadian crude petroleum used is much inferior and heavier than American, the gravity being 31° and 32°, and produces a large quantity of tar—American crude being about 45°, and comparatively free from tar. Gas oil of 35° gravity, costing about the same as crude, is now being used with more satisfactory results.

Condensation in Holders and Distribution.

This is a point that has considerable effect upon the unaccounted-for gas account and illuminating power, and one that came up in the discussion on my paper last year. I was not able to give definite information regarding it, not having then had the opportunity of making any satisfactory test. Since then I have given the matter a good deal of attention, and I am satisfied that but very little condensation takes place after the gas leaves the works—in fact, almost none.

Of this I have obtained proof in various ways. I put 5 feet of the gas into a meter prover. Seven days after, with the thermometer and barometer the same as at first, no loss whatever had taken place. Three days after, at same temperature, there was a loss of 2 per cent.

In another experiment no loss was shown until the sixth day, when a diminution of 1 per cent. took place.

On making a third test, no shrinkage took place until the fifth day, and on the eleventh day but 2 per cent. loss was shown.

During the time of the experiments the temperature ranged from 52° to 67° F.

The illuminating power of the gas was taken at the commencement and close of each test with a Sugg's illuminating power meter, and no perceptible difference was shown.

The gas was kept in a holder at the works for four days, without any apparent loss in quantity or candle power, the candle power being taken with a jet photometer. This is not as satisfactory a test as to loss in quantity as the former ones, as the temperature at its commencement and close was not carefully noted; but it was more satisfactory as showing that, notwithstanding its exposure to a low temperature, the gas retained its illum-

inating power—the gas being tested in March in a holder in the open air, and the difference between the highest and lowest temperature being considerable.

In February and March last a burner was supplied with gas passed through a half-inch pipe a distance of 20′, with a fall to catch condensation, exposed to the temperature during three weeks of cold weather, and, notwithstanding the thermometer registered as low as 6° F., the light was unaffected, and no condensation whatever was found.

Statement Showing Illuminating Power and Purity of Gas Supplied by the Consumers' Gas Company for the Year ending Sept. 30, 1880. Made by Government Inspector.

1879–80.	Illuminating Power.					Sulphur per 100 Cubic Feet.					Ammonia per 100 Cubic Feet.					Sulphuretted Hydrogen—Times Present.
	Highest Candles.	Lowest Candles.	Average Candles.	Stand'rd Candles.	Number Tests.	Highest Grains.	Lowest Grains.	Average Grains.	Stand'rd Grains.	Number Tests.	Highest Grains.	Lowest Grains.	Average Grains.	Stand'rd Grains.	Number Tests.	
October	15.05	13.18	14.25	12	4	15.05	8.36	11.89	20	4	15.35	1.77	9.59	2	4	0
November	15.35	13.89	14.49	12	8	13.82	9.69	10.91	20	4	17.73	3.02	9.08	2	4	1
December	16.38	13.93	14.91	12	9	14.32	8.85	11.74	20	4	2.50	0.50	1.49	2	4	1
January	17.65	14.62	16.09	12	9	12.50	8.30	10.53	20	4	2.26	1.50	1.82	2	4	1
February	16.54	14.74	15.90	12	12	12.19	7.51	9.60	20	4	1.50	1.01	1.26	2	4	0
March	16.46	14.52	15.71	12	14	10.50	9.21	10.02	20	4	1.75	0.25	1.06	2	4	0
April	16.98	15.12	16.06	12	8	17.49	11.28	14.14	20	4	0.76	0.25	0.44	2	4	0
May	16.84	14.67	15.76	12	8	13.10	7.61	10.37	20	4	1.52	1.00	1.26	2	4	0
June	16.81	15.16	16.11	12	8	13.14	9.41	11.15	20	4	1.81	1.00	1.47	2	4	0
July	16.81	15.23	16.17	12	8	12.26	9.25	10.35	20	4	1.55	1.00	1.27	2	4	0
August	16.28	15.55	15.89	12	7	9.24	6.89	8.06	20	4	1.54	0.77	1.08	2	4	0
September	16.43	14.23	15.72	12	7	12.50	8.26	10.11	20	4	1.25	0.50	0.87	2	4	0

Mixed gas supplied until February 17; after that, all Lowe gas. Tests made with a Bunsen bar photometer. Burner used, Sugg's 24-holed London Argand No. 1. Place of testing, about three-quarters of a mile from the works.

The following comparative statement of the unaccounted-for gas account for a number of quarters in this connection may not be uninteresting:

Statement of Unaccounted-for Gas.

Quarter Ending.	Gas Manufactured	Loss. Quantity.	Loss. Per Cent.	Per Mile Pipe Laid. Per Quarter.	Per Mile Pipe Laid. Per Diem.	Miles Pipe Laid.
September 30, 1878	All coal.	4,430,100	19.75	52,118	572	85.00
Do. 1879	44¼ per ct. Lowe.	4,615,000	18.25	50,614	556	91.18
Do. 1880	All Lowe.	3,610,200	13.70	37,039	407	97.47
December 31, 1878	All coal.	6,956,200	15.75	80,225	872	86.71
Do. 1879	31 per ct. Lowe.	5,960,500	12½	64,291	656	92.71
March 31, 1879	11½ per ct. Lowe.	6,250,400	15.50	72,084	792	86.71
Do. 1880	78⅝ per ct. Lowe.	3,327,700	7⅞	35,893	394	92.71
June 30, 1879	47 per ct. Lowe.	4,306,900	17.25	49,464	543	87.07
Do. 1880	All Lowe.	1,864,200	7.34	19,916	218	93.60

Between August 1 and October 16, 1879, about 1,600 yards of 20-inch pipe were substituted for smaller sizes, as a trunk main, and between the middle of May and the middle of July, 1880, it was extended 2,200 yards further.

The day pressure was considerably increased in July last, in consequence of an increased demand for gas in the daytime. The night pressure on the mains supplying the principal portion of the gas consumed was increased about one-seventh in December last, but notwithstanding this, however, the supply was defective.

In the middle of July last, when all the connections were made to the trunk main referred to, the pressure was reduced to what it was before. This, however, gave a very much higher pressure in certain localities where there had been a deficiency before, even with the higher pressure. This and the increase in the day pressure referred to will at all events partially account for the increase in the unaccounted-for gas account in the last September quarter, as compared with that of June last.

No leaks of any consequence were found in the pipes replaced by the 20-inch main referred to, nor elsewhere during the last two years.

The station meters were tested and found correct. The workmen all say that there is not a quarter of the condensation in the drips that there was formerly.

I do not claim that the whole of the reduction shown recently has resulted from the cause referred to, but I cannot but conclude that it is mainly to be attributed to it.

Specific Gravity.

The specific gravity obtained by the effusion method, with the apparatus designed by Mr. W. W. Goodwin, averaged about .560. I did not obtain that of the coal gas, but assumed it to be .443—the approximate gravity of 15-candle gas. Theoretically, about one-eighth more pressure would be required, and in practical working that addition to the pressure at the works gave the same pressure on the burners in various localities, as there was when coal gas was supplied. I also verified this by testing both gases with a meter and burner prover.

Heating Power.

Not having any analysis of the gas from which to obtain this theoretically, I tested both gases in a somewhat crude manner, with the results shown in the table on the following page.

The water was put in a covered tin vessel, and the thermometer inserted through a hole in the cover. The burner used was a common batwing, and the vessel was in all cases suspended at the same distance above the flame.

The time was carefully noted, and the gas was passed each time at the same pressure from a meter prover through a burner tester. The temperature of the room in each test did not vary more than two degrees.

Date of Test.	Minutes Taken to Raise Temp. from 70° to 120°.		Cubic Feet of Gas Consumed.		Size Burner Used.
	Coal.	Lowe.	Coal.	Lowe.	
Jan. 23, 1880.	16.00	15.15	1.20	1.14	4½ feet.
" 24, 1880.	16.45	....	1.25	.....	4½ feet.
" 24, 1880.	10.30	.....	1.22	.....	7 feet.
" 26, 1880.	.....	15.00	.....	1.12	4½ feet.
" 27, 1880.	16.30	.....	1.23	.....	4½ feet.
Oct. 9, 1880.	.....	16.14	.....	1.21	4½ feet.
" 9, 1880.	.....	16.14	.....	1.21	4½ feet.

Quantity of water used, 2.75 lbs.

I cannot account for the different results obtained from the Lowe gas on October 9, except that the composition of the gas must have varied at different times. The results of the tests ore only claimed to be approximately correct.

Residuals.

The only available residual is the tar, and this contains a large quantity of water, some of which it retains mechanically even after boiling. Passing it through a sieve has had the effect of removing a large proportion of the water, and we have hopes of being able entirely to remove it eventually.

The following analyses of the tar were obtained from Dr. W. H. Pike, Professor of Chemistry, University College, Toronto:

Per 100 parts by weight—

Water.....	28	Corresponding to		Water	0
Light oil.....	3	"	"	Light oil.....	4
Naphthaline.....	18	"	"	Naphthaline.....	24.5
Anthracine oils...	13	"	"	Anthracine oils...	18.2
Pitch.....	38	"	"	Pitch	53.3
	100				100

Owing to the large quantity of water that runs away with the tar, it is difficult to say accurately how much is made. I should judge it to be between 15 and 20 per cent. of the oil used.

Purification Requirements.

We have found lime to be the only effective purifying agent we have tried. Oxide of iron has been tried, but in a few days it is converted into a thick paste, owing to the oily nature of the gas, and fails to take up the impurities, and it cannot afterwards be renewed. Lime thoroughly slacked and allowed to remain so for a couple of days before using, produces much better results than lime slacked and used immediately, about 40 per cent. more gas being purified to the bushel. Owing to the gas being made with great rapidity, larger purifiers, with deeper cups, are required than for coal gas, each generator producing about 5,000 cubic feet per run of 20 minutes. Passing the gas into a small holder before purification would, no doubt, remedy the difficulty, as it could be passed regularly, and at such pressure as might be found best. At present we aim at commencing to run each set a few minutes after the other in order to accomplish this.

Obstructions.

The only difficulties of any importance that have been experienced have arisen from naphthaline. But little trouble was experienced or expected from this until about a month since, just as the cool weather commenced or provision would have been made to obviate it by conveying the gas for some distance over tar as is done in coal gas works. The difficulty, however, is not as great as that we have experienced from the same cause with coal gas, and is confined to the pipes in the works, and a number of services where they enter the houses.

There have been no obstructions whatever in the mains. Some which were taken up last week within a short distance from the works were almost as clean as when they were put down years ago.

Trouble has also arisen from the closing up of the lava tip burners with a substance as hard as the burner itself, which forms on the side of the orifice, and increases until the burner is closed up, and which cannot be removed. Oxidation and the deposition of carbon have been suggested. The difficulty was not altogether unexpected, as we were informed that elsewhere lava tip burners would not answer.

The most peculiar and apparently unaccountable feature is that these stoppages are almost entirely confined to burners in houses at the extreme limits of the mains, and are not caused by any impurities carried forward in the gas. The evil does not exist to any extent, and the substitution of brass burners remedies it, as they are never affected in a similar manner.

This trouble is not confined to Lowe gas, as I have been informed by the manager of a coal gas works that some of the burners of his company were affected in a similar way.

Wear and Tear.

Since the erection of two sets of apparatus in February, 1879, $603.87 have been expended in repairs. This expenditure was for re-lining two of the generators, sundry repairs to others, and to the superheaters, and taking down and re-building and altering brick work for boilers. Part of this expenditure was rendered necessary by some of the blocks in the generators being unsuitable for the purpose. The gas made by the apparatus during this period was 126,030,000 cubic feet.

Cost of the Apparatus.

As information upon this point was particularly desired by several members at the last meeting of the Association, for their benefit, and that of any others who may desire it, I now furnish it.

The two sets, with generators 10′ 6″ × 5′, and superheaters 15′ × 4′, with all connections, and a 25-horse power engine and boiler, working gallery 30′ × 36′, oil storage tank, and two oil distributing tanks, purchased from the patentee cost $8,600. The five sets of similar size with gallery, all valves and distributing tanks, connections and foundations, one 25 horse power engine, two boilers, steam hoist, four oil storage tanks of 42,000 gallons wine measure capacity, etc., cost $20,000.

Conclusion.

Owing to having to wait until a few days ago to obtain information for insertion in this paper, I have had to prepare it at a time in which I am the busiest of the whole year, and much more hastily than I could have desired. It is consequently not as complete as it would otherwise have been. I can only say that it is as full as I could make it under the circumstances. I trust, however, notwithstanding the imperfect manner in which I have presented the facts given, respecting the working of the process, the objects which I have in view, and referred to in my introductory remarks, may to some extent be secured.

The reading of the paper was greeted with applause.

Mr. Forstall—Before the discussion on the paper commences I beg leave to present the following report of the Committee on Weights and Measures:

CHICAGO, October 14th, 1880.

To the President and Members of the American Gas Light Association:

Gentlemen—Your Committee, to whom was referred the matter of a standard for weights and measures to be used exclusively by the members of this Association in comparison of results, beg leave to make the following recommendations:

1. That all statements of gas production be made in cubic feet per pound of coal, specifying the kind and quantity of enriching material used—if it be cannel, in percentage of the total weight, and if naphtha, in gallons per 1000 cubic feet of total gas production.

2. The U. S. standard bushel of 2150.42 cubic inches, for the measurement of coke and lime. Statements of lime to specify whether slaked or unslaked.

3. The U. S. standard gallon of 231 cubic inches for the measurement of tar, naphtha, oil and ammoniacal liquor.

4. That all statements of illuminating power be accompanied with the description of the burner and photometer used in testing; and we further recommend the general adoption of Sugg's London "D" burner.

Respectfully submitted,

THEOBALD FORSTALL,
A. B. SLATER,
G. S. HOOKEY,
Committee.

On motion, the report was accepted.

Mr. Brown—I would like to ask Mr. Forstall if, in naming a ton, he means a ton of two thousand pounds, or a ton of two thousand two hundred and forty pounds?

Mr. Forstall—We have thrown out the ton altogether.

Mr. Brown—It may be necessary to name it in some instances.

Mr. Forstall—The production is referred to as so much to the pound of coal.

Mr. Brown—In some cases you might want to use a ton.

Mr. Forstall—We found that in the New England states, and along the

Atlantic seaboard, and along the Gulf of Mexico, a ton means twenty-two hundred and forty pounds. In the Middle states, and in the West, it is two thousand pounds. Any member mentioning a ton can always state whether he means a ton of two thousand or a ton of twenty-two hundred and forty pounds. Any ton we should adopt would only be the ton of the members of the Association. We thought it better to ignore the ton entirely, and refer to the production as so much per pound of coal, the price of coal always being stated in tons of so many pounds.

Mr. Wood, of Syracuse—There is still another ton, the retail coal dealer's ton. [Laughter.]

The Secretary—I move that the report of the Committee be adopted. (Carried.)

The President—We are now ready for any remarks on Mr. Pearson's paper. I hope the members of the Association will not hesitate to express their views.

Mr. Littlehales—I am rather disappointed in Mr. Pearson's paper, especially so since we have got no financial results, and the financial question is the one we have got to fall back upon at last. The mere fact of getting so much gas out of so many pounds of coal and oil, etc., is only one side of the question. There may be a great many other things affecting the general financial result. Unfortunately, Mr. Pearson has omitted that entirely, and I think the Association will very much regret that fact.

Mr. Pearson—What do you refer to particularly?

Mr. Littlehales—I am simply speaking of the financial advantage or disadvantage to your company with reference to dollars and cents.

You are all aware that when a saint is to be canonized there is one appointed called the "Devil's Advocate," who is supposed to bring forward all he can against the saint, so that if he goes through the ordeal successfully he shines all the brighter afterwards. So I propose advancing all I know against Mr. Pearson's process, in order that the Association may have the advantage of his refuting it so far as he can. First, I would like Mr. Pearson to tell us his highest and lowest record of the illuminating power. He gave an average of 15.91.

Mr. Pearson—The lowest record is 14.23, and the highest 16.98.

Mr, Littlehales—Most of you know that I am a pretty near neighbor of Mr. Pearson, and consequently I go around and take notes occasionally. I have been through his place very frequently. I have been there when the gas has been first rate, and I have seen it when it has been simply abominable. I have seen it when it has probably been twenty candles, and I have seen it when it has not been ten. I do not know that that is an evil inseparable from the system; but I know that, so far as my observation is concerned, that is a fact. I also know another fact, and that is that the city of Toronto is obtaining a rather unenviable notoriety for its bill of mortality. Within the last few months there have been two or three killed and two or three disabled by the gas there. These accidents have been generally attributed to the ignorance of the Canadian backwood's-man in not knowing enough to turn off the gas, but blowing it out. There is a good deal of ignorance unquestionably in that section, but I do not think this somewhat extraordinary bill of mortality arose from that. I think it arose where the gas had not been turned off, or possibly turned on again. Several deaths have occurred. That fact Mr. Pearson has not referred to, which is rather unjust to this Association. We want to get at the bottom facts in regard to this process, and if death is likely to ensue from its use, I think one human life is more valuable than twenty Toronto gas companies, or any other gas company, or twenty Lowe processes, or any other process. Human life is too valuable a thing to tamper with, and if there is anything in the process which may endanger life I think we should investigate the matter to the bottom. There is this fact that several lives have been lost there. There is this further fact, which has come under my own observation, that, in one or two instances, people have been disabled. There was one case that I was informed of by a hotel manager in our part of the country where a man was subjected to the influence of this gas, and it was two or three days before he was able to leave his bed. Besides there have been several other cases that I could mention. These are facts that ought to enter into the consideration of this question. The mere fact of making a few feet of gas extra per pound of coal is a very small matter in comparison with the value of human life. That is a point that I hope Mr. Pearson will refer to.

Then there is a difference in the illuminating power of the gas, as I have explained before. I have seen it sometimes when it has been very good, and I have seen it at other times when it has been simply miserable. I have inquired among the people of Toronto, hotel keepers and private consumers, and I have heard very unfavorable accounts. As a matter of fact the press of Toronto speaks very unfavorably of it. Perhaps that may not be regarded as very high authority upon gas matters; but I simply quote it in corroboration of my own observations. I happen to have a slip cut from the Toronto *Globe*, of October 9th, which I will read to the Association simply to show that there is a certain amount of dissatisfaction with the gas, and to give Mr. Pearson an opportunity of replying to it.

Mr. Pearson—I have got it here and will read it for you. This has not been unexpected:

"The gaslight throughout the city last evening was very bad, and it has been bad, in a greater or less degree, for several days past. It varies considerably. In some places it is fairly good, while in others it is wretched. Complaints are common and they are quite proper as well. In many public and private houses the light is not more than fifty per cent of what it ought to be."

Mr. Littlehales—"The gas light throughout the city last evening was very bad, and it has been bad, in a greater or less degree, for several days past." I simply call attention to that to corroborate my own observations. Now, the tar that Mr. Pearson speaks of is the only available residual product—the only one of any commercial value. I wish Mr. Pearson would give us what the commercial value of it is. We have been to considerable cost in building tanks to store it in, and we cannot get rid of it. That, of course, will lessen somewhat the economical value of the article. Hence the necessity of having the thing brought down to dollars and cents.

Then there is the question of leakage. There is something that we can see. If the effect of changing from coal gas to water gas reduces the leakage by ten per cent., or, in other words, if prior to the adoption of this water gas process the leakage was 17.50, and afterwards it was only seven, without any alteration of the main service, that fact certainly deserves our careful consideration.

Mr. Pearson—I referred to the alteration of the twenty-inch main on the front street.

Mr. Littlehales—I was under a misapprehension then. If the mains were altered, then the argument that the decrease of leakage was due to the gas falls to the ground. If the mains were altered, then the decrease of leakage was due rather to the alteration of the mains than to the gas itself.

Mr. Pearson—If you had listened carefully to the reading of the paper, you would have heard what I said. I accounted for the difference by the fact that a main was laid on the front street, and that we reduced the day pressure some twelve per cent. After we reduced our pressure there was a greater supply going to the western and central portions of our city than there was before, and the pressure, as taken at various points, was higher than it was previous to the reduction, and, therefore, the leakage would not be reduced on that account.

Mr. Littlehales—Possibly some other members of the Association are under the same misapprehension as myself—that the reduced leakage was on account of the water gas.

Mr. Pearson—I said that I believed it was mainly attributable to that.

Mr. Littlehales—That comes to precisely the same thing. If it is mainly attributable to that fact, I think the thing requires some further explanation, because the only difference should have been that due to the different specific gravity. Of course, if it is due to the alteration of the main, then the process should not receive credit for it.

Mr. Pearson—I do not admit that it is due to the alteration of the main, entirely or mainly.

Mr. Littlehales—Will you please tell us which horn of the dilemma you take?

Mr. Butterworth—Will you please read that passage again?

Mr. Pearson—Certainly. I do not suppose, of course, that it is possibe to remember everything. This is what I said: "Between August 1 and October 16, 1879, about 1,600 yards of 20-inch pipe were substitued for smaller sizes as a trunk main, and between the middle of May and the middle of July, 1880, it was extended 2,200 yards further. The day pressure was considerably increased in July last, in consequence of an increased demand for gas in the daytime." Some of our people were using gas stoves, and complained of want of pressure. "The night pressure on the mains supplying the principal part of the gas consumed was increased about one-seventh in December last, but notwithstanding this, however, the supply was defective. In the middle of July last, when all the connections were made to the trunk main referred to, the pressure was reduced to what it was before. This, however, gave a very much higher pressure in certain localities where there had been a deficiency before, even with the higher pressure, and this and the increase in the day pressure referred to will at all events partially account for the increase in the unaccounted-for gas account in the last September quarter, as compared with that of June last." When the largest increase took place in June last, these connections were not made. The using of the Lowe gas sent our leakage account down 7½ per cent. In July, when all the connections were made, although there was a decrease of the night pressure, the pressure was increased in certain portions of the city where there had been a deficiency before.

Mr. Littlehales—So that I understand the reduction was not mainly due to the alteration of the mains?

Mr. Pearson—I did not say that it was.

Mr. Littlehales—Will you kindly state whether this reduction from 17 to

7 is due to the difference in the gas or to the different condition of your mains?

Mr. Pearson—I think it is principally due to the difference in the gas, and partly due to the alteration in the mains.

Mr. Littlehales—How much to each?

Mr. Pearson—That is a very difficult thing to get at.

Mr. Littlehales—These are points on which our judgment of the process would be formed.

Mr. Pearson—It is a fact that the larger proportion of Lowe gas we use, the less leakage we have. That is a fact which my statements, when carefully read, will, I think, establish.

Mr. Littlehales—The lack of definite information in regard to results, I think is to be regretted. I would ask Mr. Pearson if he could not, on some future occasion, give us, in dollars and cents, what it would come to; because, after all, that is the main question, and his balance sheet at the end of the year may not show results that would be entirely satisfactory to us.

Mr. Pearson—I suppose I had better begin and reply to Mr. Littlehales, commencing with the last inquiry. In the first place, with regard to the financial results, I did not think it was exactly fair for me to come here and say how much more money our company has made since it commenced using the Lowe process than it did before. I have embodied in my paper a statement of facts, and have given figures showing certain results. I do not think it concerns this Association to know exactly what benefit the Toronto Gas Company has derived from the use of this process. What the members of the Association want to know is, I suppose, what benefit they could derive from making gas in this way. I think, after they have read my paper carefully, they can make that out for themselves, without my telling them. I am not going to tell exactly how much money we made. I am willing to tell any gentleman privately, and I have no objections to telling Mr. Littlehales privately, but I shall not make a public statement of it. I will simply say, however, that we have made considerable more money during the last year, with about 10 per cent. increase of consumption, than we ever made before, notwithstanding the reduction of 25 cents in the price of the gas, on about 100 million cubic feet. That is something definite, I am sure. That reduction took place on the first day of October of last year. We are now selling gas to our large consumers—those using 200,000 feet—at $1.50 per thousand, and to those using less than that, at $1.75. So much for that. In regard to the luminosity of the gas, I am not at all surprised at Mr Littlehales' remarks. I expected to hear about that. He has made the statement that he has seen the gas when it was only 10-candles. I should like to ask Mr. Littlehales how he knows that it was only 10-candles?

Mr. Littlehales—I have the Government Inspector's returns here.

Mr. Pearson—I have them here also, and mine are official.

Mr. Littlehales—I was speaking then more particularly from my own observation.

Mr. Pearson—I have the Government Inspector's returns here, and he has never reported the gas lower than the figures I have given in my paper. I make that statement most emphatically, and I will make no further observation upon that point.

That there have been complaints in regard to the gas I admit. I believe every gas company has complaints, and I presume Mr. Littlehales himself has had some experience in that direction. We have had several complaints lately, but they have arisen, to a very great extent, from the fact that consumers could not discriminate between quantity and quality. In a great many instances the pipes have been partially stopped, and nothing else was the matter. In every case where this was the cause of complaint, when we have remedied it, the consumers have been satisfied with the gas. It is not an easy thing for persons not accustomed to it to measure the flame that comes from the burner. If it is from 20 to 25 per cent. less in size, they do not notice it, or, at least, they do not think it is the fault of the pipes. They attribute it at once to the fact that we are making gas by water, and they have a prejuce against it. They say that the want of illumination is because we are using that process. I am going to make an admission in regard to variation, by way of explaining how it happened. On some occasions there has been a variation in the gas, and the reason has been that the inlet and outlet pipes to the holder have been close together, and we make gas so rapidly that some of it has gone off almost as soon as it has been made. We are going to remedy that by putting in another holder and supplying the gas more thoroughly mixed. I do not admit that there has been any very great variation in the gas at all. I do not admit what Mr. Littlehales says—that the gas has been down as low as 10 candles. I do admit that there has been some variation, from the cause I have just stated. I repeat the statement that most of the complaints that have been made have been attributable to the fact that the pipes have been partially closed up.

Now, in regard to the poisonous nature of the gas. I suppose that most of the members of the Association saw a correspondence which took place between Mr. Littlehales and myself in the columns of the American Gas Light Journal, in which I replied to certain statements he had made in referring to the cases of those whom it was supposed were poisoned by the gas. For the information of those members who may not have seen that correspondence, and for the purpose of refreshing the memories of those who have, I will, with your permission, read what I said upon that point. This letter will be found in the American Gas Light Journal of August 2, 1880:

The facts as obtained from the proprietor of the hotel are as follows:

"A woman over seventy years of age, very feeble and almost utterly exhausted, arrived by a late train and retired at about 11 o'clock. The porter, as instructed, called her at half-past five the next morning; he receiving no answer, and fearing from the woman's appearance on the evening previous that something was wrong, immediately burst open the door, and found her lying face downward on the floor with her head toward the door. There was a strong smell of gas in the room, and the tap was found open. A doctor who was near at hand was called in immediately, and pronounced her dead. Her friends were communicated with, and on their arrival did not seem surprised at her death. An inquest was not held, because under our existing laws no coroner can hold one without taking an affidavit that he believes that the death took place from foul play.

"I saw the doctor some time after, and on my asking him what means had been taken to resuscitate her, and expressing my surprise that death should have taken place so soon, said that there was no question about her death, as she was *quite cold* when he examined her. From this circumstance she evidently must have been dead some time before discovered.

"The room in which the woman died was 10 feet by 6 feet by 9 feet, and both the window and door were closed. The burner (which I have) consumed 2½ feet per hour at one inch pressure, which was about that on the building during the period of the escape.

"Allowing that the escape continued six hours, 15 feet in all would have escaped in the room. Now, as the Lowe gas, as analyzed in Canada, contains less than 20 per cent. of carbonic oxide, but three cubic feet, or .55 per cent., could have been present at the expiration of the six hours. Apparently the woman was dead some time before, when a smaller proportion was present; and, moreover, was lying on the floor where there would be less gas than in the upper part of the room. Could the carbonic oxide in the gas or the gas as a whole, have been the sole cause of her death? I do not believe it; and in support of this opinion give the following instances in which people have recovered after inhaling Lowe gas here, and in one of which a very much larger quantity must have been inhaled.

"A man at one of our hotels retired at 11 P.M., blew out his gas, which continued escaping until 5 P.M. the next day—18 hours. The room was only 10 feet by 8 feet by 9 feet. The window and door were shut during the whole time, and fitted very closely, and the burner consumed fully three feet per hour—the person recovered, though with much difficulty. This happened in February last, when we were making about four-fifths of Lowe gas.

"The other case is that of a young gentleman who, by some means or other turned the gas on after extinguishing it, and inhaled it, in a room with door and windows shut, for about four hours. I have not got the size of the room or the burner. He was found lying on the floor quite insensible. He recovered on restoratives being applied—went to church on the same morning, it being Good Friday, and to a party in the evening. He merely complained of a headache during the day, and was as well as ever the day after. The gas was all Lowe gas.

Our men employed in laying mains say they are overcome with the gas a little quicker than they were with coal gas, but *recover sooner*, and, after a sleep, always feel as well as ever."

I dispute the case of the woman Mr. Littlehales refers to.

Mr. Littlehales—Tell us about the other cases.

Mr. Pearson—I will toll you about one of them. I have not in my possession definite information in regard to the other.

Mr. Littlehales—When did the accident to this lady take place?

Mr. Pearson—The date of that ————. I do not know, Mr. Chairman, whether this is a relevant question or not. I suppose it is admitted that every gas will kill people. I do not suppose that the question before this Association is whether the Lowe gas will kill people or whether it will not kill people. I can give the cases; but is it desirable that we should here discuss a question of this kind, knowing that all gas is poisonous? I will admit that Lowe gas is poisonous, and you must all admit that coal gas is poisonous also. If the Association desire it I have no objection in the world to going on and giving further information; but I do not know whether it is desirable that I should do so.

The President—I suppose the point Mr. Littlehales makes is that the Lowe gas is much more fatal in its effects than coal gas.

Mr. Littlehales—It is something like the reputation of a certain kind of whiskey—it kills at forty rods. The question is whether with small burners

passing about twenty-five feet into a room in about six hours, the gas will kill. Giving them the benefit of the doubt in regard to the woman who it was proved was sick before she was subjected to the influence of this gas, there have been two subsequent cases, one occurring about a fortnight ago, and the other about a month ago. The first one has been referred to. The last case, occurring about a fortnight ago, was that of a man in the ——— hotel. He had been subjected to the gas for some few hours, and he died. Now, that is three deaths within about four months. Taking that as one-third of a year, there would be an average of nine deaths a year, which is a pretty big bill of mortality.

Mr. Pearson—Mr. Littlehales forces me to make a statement to satisfy you that he is incorrect in his conclusions.

Mr. Littlehales—Mr. Pearson challenges my statement about the quality of the gas. I read a paragraph from a Toronto paper—

"Alderman Bonstead presented four reports by the Government Inspector in reference to the gas supplied to the city by the Toronto Gas Company. They showed the illuminating power of the gas (twelve candles being the standard) to have been on October 5th, 12.08 candles; on October 19th, 10.62; on October 25th, 14 67; on October 30th, 11.54.

Mr. Pearson—That is manifestly incorrect.

Mr. Littlehales—This was last October.

Mr. Pearson—We were making coal gas then, gentlemen.

Mr. Littlehales—Last October?

Mr. Pearson—Yes, sir. We were unable to use the Lowe process exclusively because we had not then the means of properly purifying the gas. That is a very different statement. [Laughter.]

Mr. Littlehales—But you said you commonced the Lowe process in February, 1879, and this is October, 1879?

Mr. Pearson—Yes; I said we *commenced* using the Lowe process at that time; but we did not use it exclusively. My paper only goes back to Feb ruary, 1880, since which time our gas has been made by the Lowe process alone.

Mr. Littledales—I am speaking about your statement that you commenced the Lowe process in February, 1879, and this refers to October, 1879.

Mr. Pearson—I have already said that we *commenced* the Lowe process at that time; but at the dates given there, we were not making over one-third of our gas by the Lowe process for the reason that we had not the means of proper purification. You can not put that down to Lowe gas.

Mr. Littlehales—I merely wanted to call your attention to the fact that you might have an opportunity of explaining it.

Mr. Pearson—I believe I have done so. As Mr. Littlehales has made a statement in regard to one of the cases where death ensued from the effects of the gas, I will give you the facts as published, and you can form your own opinion whether, under the same circumstances, coal gas would not have been fatal. The man retired between six and seven, and the gas was turned off or blown out at half-past twelve o'clock. He was discovered at half-past five the next morning. At the pressure at the hotel the consumer's burner would pass six feet an hour, making some thirty feet. The room was 18 by 10. The windows were bull's-eye windows in the top story, and were closed perfectly tight. The man lived about five days. He inhaled the gas from half-past twelve until half-past five in the morning. There is no question but that the gas is poisonous. You see, however, that the man was a very long time under its influence. Furthermore, his friends say he was subject to brain trouble before that time; but I will admit that was a case of gas poisoning.

Mr. Littlehales—Which case do you refer to?

Mr. Pearson—To the man who died at the ——— Hotel.

Mr. Littlehales—What about the man who died at the La Salle Institute?

Mr. Pearson—I have not full information in regard to that. Mr. Littlehales smiles incredulously. He may smile if he likes. I have here a statement that was published in regard to it which contains all the information I have upon the subject—

"An old man, 61 years of age, employed as a tailor at the La Salle Institute, turned the gas on in his bedroom; but as it did not ignite when he applied a match he thought there was none in the pipe, and forgetting to turn the tap off again he went to bed and died on Saturday from suffocation by gas. Not appearing for breakfast, it was supposed he desired to take a sleep, and no person went to his room until about one o'clock the next day." He went to bed early in the evening, and at one o'clock the next day he was found in a state of unconsciousness. He lived a few days aftewards and then died.

Sometimes it is not desirable for gas companies to inquire too closely into these cases, because it creates a great deal of noise, and no good results from it. I did not think it desirable that I should make any further inquiry after that statement. Mr. Littlehales stated that three deaths had occurred from poisoning by the gas within a few months. I do not admit but one. It is true that these accidents occurred within a few months; but I cannot, more than any one else account for the fact that very often a great many troubles come together, or, as the saying is, "misfortunes never come singly." I know a gas company that blew up two gasholders, one after the other. At that rate how many gasholders would be blown up in 20 years? Twenty years ago we were unfortunate enough to blow up a man's house with coal gas. The same year, or the next year, there were two girls poisoned in a hotel by coal gas, and very near the same time a person was poisoned in a house by the gas leaking. Here was a series of accidents, one of those strange events which sometimes occur that we cannot account for. There were four accidents from coal gas within about a year. At that ratio we ought to have had, within 20 years, 80 accidents, but we have not. Mr. Littlehales argument upon that point, therefore, does not prove anything. There is no question but the gas will kill people. I admit that, and I suppose coal gas men will admit that coal gas will kill. I have answered Mr. Littlehales's question about profit and loss. What benefit our company derived from the use of the Lowe process does not so much concern this Association as does the question of what benefit it is likely to be to you. It has been of great benefit to our company financially. I say that without hesitation. I suppose Mr. Littlehales will ask if the cost of the plant and interest is included in my statement.

Mr. Littlehales—Undoubtedly.

Mr. Pearson—In reply to that I will say that so far as we are concerned we were going to build a new retort house anyway this season, and we intended, in connection with the retort house, to build a purifying house. Now, the only expenditure we have been at in that respect was merely anticipating, by a couple of years, what we would have done in any event. The expenditure for the Lowe process was, of course, a little more than we would have expended to put in retorts, hydraulic mains, and other things; but, taking the whole expenditure for the Lowe process, we did not lose anything in interest because we have not now to store our bituminous coal which, as Mr. Littlehales knows, has to be laid in in advance for the season's work. We would have had to lay in from sixteen to seventeen thousand tons of bituminous coal for the winter and the next year's consumption. We would have had to purchase property in order to have stored that coal for a large works. Under the present system storage room for four thousand tons of coal is ample. We take that out, and other things that we have not had to supply, and the interest is in favor of the Lowe process so far as we are concerned. As to what you may do that is a matter for yourselves.

Mr. Helme—I think, with Mr. Pearson, that we all know that carbonic oxide will kill. The only question is whether gas made from the Lowe process is more injurious in this respect than gas made from coal. This thing of people going into hotel rooms and blowing out the gas and going to sleep is something that I cannot very well understand, and is certainly something which we cannot control. The Almighty has given to gas one thing which ought to suggest to people that there is danger in it, and that is its very pronounced and disagreeable odor. If a man will not take advantage of that hint, and will blow out the gas when he goes to bed, we are certainly not responsible for it. But we are responsible for this—whether the kind of gas we supply is less detrimental to health than another kind; and that which is the least detrimental to is the kind we ought to supply to our consumers. Now, I do not know whether Mr. Pearson has any information on the subject, or whether any member of the Association has any facts by which we could tell whether the Lowe gas is any more poisonous than coal gas. I have heard a gentleman who is using Lowe gas, and has used it for some time, and who is making it, say that there has been some talk about it, and that he thought there was something in it; but that, at the same time, his consumers did not complain of it. That is, after all, the real question we are interested in. If a man will sleep where gas is escaping, whether it is Lowe gas, or coal gas, one will kill him as surely as the other, if he is under its influence long enough.

Mr. Allen—Let me say one word here in relation to the poisonous effect of water gas. It seems to me that if gentlemen who are making coal gas would look to their own interests, they would not raise the question of the poisonous nature of water gas. They are raising a point against themselves that will before long be taken advantage of more than it is at present.

The President—Mr. Allen will be good enough to confine himself to the question that is now before us.

Mr. Allen—I was referring to the poisonous nature of gas—the very point that has been under discussion.

The President—The question is not upon the poisonous nature of gases generally. But the question before us is upon the statements of Mr. Pearson's paper.

Mr. Allen—If these gentlemen have been allowed to occupy all this time in talking upon the poisonous nature of gas, and making statements unfavorable to water gas in that respect, I think I ought to be allowed to say a word.

The President—They have occupied very little time upon that subject.

Mr. Allen—I will not occupy as much time as they have. It is well-known in the community that eminent physicians have used carbonic oxide as an

anæsthetic, whereas carburetted hydrogen, or marsh gas, such as is found in the bottom of wells and in mines, and which 45 per cent. of the ordinary coal gas consists of, will kill a person instantly.

The President—I must insist upon order.

Mr. Coggshall—Mr. Pearson has presented a paper in which (though we may not agree with him as to his conclusions) he has given us certain facts which every gas engineer present can compare with his own results, and decide for himself whether or not there is any profit in adopting the Lowe process. Having gone into the matter so thoroughly and completely as he has, I move that a vote of thanks be tendered to him. (Carried.)

Mr. Allen—I would like to make one other remark on the subject of the poisonous nature of water gas.

The President—I cannot allow it. We have not gone into a general discussion of that subject, and it is not fairly before us. The fact that something may have been said about it in the discussion that has taken place upon Mr. Pearson's paper does not justify you in violating the rules.

Mr. Allen—I am not going to violate any rules. It does not seem as if I could say anything without being called to order.

Major Dresser—This matter of naphthaline that was referred to by Mr. Pearson is one of a great deal of interest. It used to be supposed that there was no naphthaline in oil gas works, but here is a little specimen—a solid cylinder of naphthaline four inches in diameter, and about a foot long, was shown—evidently naphthaline (laughter), from the inlet of the holder at the Municipal gas works, where water gas is made. It was made by simply dipping a stick into the trap in this way and lifting it up and down. It is an interesting specimen. I suppose you gentlemen know what it is; if you do not, I have the pleasure of informing you that it is naphthaline. (Laughter.)

Mr. Pearson—Major Dresser has produced a specimen from the Municipal water gas when Mr. Allen could not speak upon the subject of water gas. He has given us something from another process that is not the Lowe process, and I do not think it is quite fair that he should present it here as a specimen from the Lowe process in Canada. (Laughter.)

Major Dresser—I beg Mr. Pearson's pardon. I had suuposed the discussion on his paper was ended, from the fact that a vote of thanks was extended to Mr. Pearson. Mr. Pearson, in his paper, referred incidentally to naphthaline, and I simply presented this specimen as a piece of pleasantry, and as a matter, perhaps, of some interest.

Mr. Somerville—Do the coal gas and the Lowe gas mix?

Mr. Pearson—Yes; they do mix; there is no question about that.

Mr. Starr—I understood you to say that the inlet and outlet of your holder were so near together that the gas would go out about as fast as you made it. Is there a difference in your case at different parts of the charge?

Mr. Pearson—I admitted that on some occasions this was the case; but we always try to prevent any such thing from taking place. I admitted that there was some variation in the gas, but not the variation Mr. Littlehales referred to; and I gave as the reason for that variation a circumstance which we can prevent in the future.

Mr. Butterworth—Did I understand you to say you made per charge 4,500 feet?

Mr. Pearson—On an average, 4,000 feet.

Mr. Butterworth—And you used 59 pounds in coal?

Mr. Pearson—In the generators.

Mr. Butterworth—How many pounds in all?

Mr. Pearson—We used 70 pounds of coal altogether.

Mr. Butterworth—Seventy pounds for 4,500 feet?

Mr. Pearson—For one thousand feet, and four gallons, or a little under, of crude petroleum.

Mr. Butterworth—How do you get seventy pounds of coal and four gallons of oil at a cost of seven cents.

Mr. Pearson—I did not say that. The seven cents refers to the labor in production. When the paper is published you will be able to understand a little more clearly.

Mr. Forstall—I think it is possible for Mr. Pearson to give us a statement of results in such a way as not to make public the financial affairs of his company. I think we can get at it satisfactorily if he will state at how much he puts the cost of the Lowe gas in the holder. Supposing your coal gas to cost you from 40 to 50 cents per thousand feet in the holder, what does your Lowe gas cost in the holder?

Mr. Pearson—The Lowe gas costs us in the holder about 15 cents less than our coal gas, in addition to whatever benefit we may derive from the non-condensibility of the gas in the pipes. That depends a great deal upon the price of coal. We have saved fully sixteen cents a thousand feet as compared with the price it cost us to put our coal in the year before we commenced using the Lowe process. We make 140 millions of feet, and you can easily figure up what the saving is.

Mr. Forstall—Does that 16 cents refer only to the difference in the amount of coal used, or does it include everything?

Mr. Pearson—It includes everything. It is our net gain over the coal gas process.

Mr. Littlehales—Taking the loss of interest on your old retort house?

Mr. Pearson—I do not admit a loss of interest. That is a matter for ourselves.

Mr. Burtis—Have you, in repairing meters, noticed any peculiar effect of the gas on the meters. Some repairers have told me that they have noticed a difference, and could tell what gas had been used?

Mr. Pearson—We have found no difference in the meters.

Mr. Forstall—In getting at this difference of 16 cents in the cost of the Lowe gas, at what price do you estimate coal, and at what price naphtha?

Mr. Pearson—We had two kinds of coal. The bituminous coal, I think, cost us, put down, $4.35. The hard coal about $3.90. The crude petroleum cost us about four cents a gallon. You can make the figures for yourself.

Mr. Starr—Have you found in them any sediment or gummy substance?

Mr. Pearson—No, sir; I have heard of some instances where there was a little collection of water in the meters.

Mr. Starr—We once used a meter where we found the whole interior surface covered with a gummy substance about half an inch thick.

Mr. Pearson—There could not have been a proper purification of that gas.

I am very much obliged to the members of the Association for the kindness and courtesy with which my paper has been received.

The President—I wish to say one word in reference to the ruling of the chair on the question of order. I think the discussion between Mr. Littlehales and Mr. Pearson was perfectly legitimate. It was not upon the general question of gases, but was in regard to certain facts in the city of Toronto which indicated that this gas was of a particularly poisonous nature. These facts were discussed at considerable length. When the discussion had nearly been brought to a close, Mr. Helme made a short speech upon the general question which, of course, was out of order; and had he not stopped so soon I should certainly have called him to order. Mr. Allen then began to speak upon the question of the poisonous nature of gases generally. I saw the discussion was running into a wrong channel, and I exercised the prerogative of the Chair and called him to order just as I would have called any other person to order who was discussing a question clearly irrelevant to the subject before us. It was not from any personal objection to Mr. Allen speaking, or from any personal feeling at all. But I must, while sitting in this place, do my utmost to conduct the proceedings of the Association in a proper manner, and keep members to the line of discussion which is relevant to the subject matter directly before us. I conceive that to be the duty of the Chair, and unless I am overruled by the Association itself I shall continue to perform that duty to the best of my ability. I did not intend to allow Mr. Helme to go on with his remarks to any length; and if he had continued I should certainly have called him to order.

Mr. Allen—I would have accepted the reproof most cheerfully if the Chair had called the first gentleman to order who was out of order.

The President—It is very likely the Chair may not have done its duty. I do not claim to be perfect in these respects. If you refer to the facts that were in controversy between Mr. Pearson and Mr. Littlehales, I think the discussion of those facts was perfectly legitimate, and that it bere directly upon the question. When it came to the discussion of the question whether one gas is more poisonous than another, that is quite another matter, and one which I think was entirely outside of the subject before us, the discussion of which was clearly irrelevant,

Mr. Helme—I accept the President's position. I had no intention of entering upon a discussion of the poisonous nature of gases in general. I simply thought that Mr. Pearson might be able to give us some information that would throw light upon the subject as to whether Lowe gas was particularly poisonous, and I was simply acting upon that theory.

[To be continued.]

Death from Gas.

Thomas Coleman, of Fall River, Massachusetts, engaged room No. 129 at the Putnam House, Fourth avenue and Twenty-seventh street, on Thursday evening, December 2d, and retired. Later a smell of gas was noticed. He did not get up when called yesterday and an investigation proved that he was dead. The gas was turned on and the supposition is that he blew it out on retiring. The body was sent to the Morgue, to be kept there until claimed by friends.—*N. Y. Herald*, Dec. 4th.

Two Men almost Killed by Escaping Gas.—P. Farragar, the proprietor, and J. Sloane, a bartender of the resort known as Cobweb Hall in Duane street, went into the cellar this morning to see what was the matter with the gas. The main pipe was broken and both men were overpowered. They were found lying unconscious on the floor of the cellar. Medical attendance was at once secured. Sloane is in a critical condition.—*Evening Post, Dec.* 11th.

THE AMERICAN GASLIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

THURSDAY, DEC. 16, 1880.

Official Report of Examinations of Gas for two Weeks ending Dec. 11, 1880, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

1880. Nov.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
		†	*	†	‡	*	†
29	Between	23.91	20.02	20.38	22.98	18.42	25.69
30		26.52	20.08	25.32	23.34	18.77	27.69
Dec. 1	9.30 A.M.	24.97	19.75	25.09	23.92	17.88	28.14
2	and	24.80	19.76	24.62	23.65	19.23	27.43
3	1 P. M.	23.98	19.73	25.42	23.43	19.09	27.10
4		24.26	19.28	26.04	24.16	19.82	28.51
	Average	24.74	19.77	24.48	23.58	18.87	27.43
6		23.39	19.09	23.16	22.72	18.59	25.58
7		25 30	19.30	24.24	23.84	19.54	27.23
8		23.25	19.61	21.89	23.29	19.23	27.56
9		22.37	19.20	22.02	22.35	19.10	28.18
10		21.73	18.32	24.28	22.84	18.17	26.68
11		22.72	18.49	23.54	23.46	17.28	26.88
	Average	23.12	19.00	23.19	23.08	18.65	27.02

* Five foot lava tip with check.
† Bray's slit union, No. 7.
‡ Bray's slit union, No. 6.

E. G. Love, Gas Examiner.

Blowing up a Gas Meter at the Old Municipal Works, N. Y. City.

A gas meter, known as a 48-inch station meter, exploded yesterday in the old works of the Municipal Gas Company in West 41st street, and John Ford and Charles Burns were instantly killed and mangled by being struck with portions of the north head of the meter. The Municipal Gas Company, who employ the Tessié du Motay process, had not made gas in the works since February, 1877, when their manufactory was established in West 46th street. In August the Company determined to utilize the old works for experiments. Mr. T. F. Rowland, of the Continental Iron Works, at Greenpoint, was given the contract for the machinery and the alterations, and Mr. W. H. Bradley, the gas company's engineer, superintended the work of fitting up the place.

Three weeks ago the American Meter Company received a second-hand 48-inch station meter, a wet one, from their manufactory at Arch and 22d street, Philadelphia. It was sent to the old works and placed in position on iron horses in the meter room by Mr. Rowland's men, and the usual attachments were made to it. It lay on the horses with the heads pointing north and south. In the south end was the indicator. The meter was so strong that it could have supported a pressure of 150 pounds to the square inch. When it had been placed in position, and after the connections were made, the end of the ordinary gas pipe through which gas passes to illuminate the works was connected with the inlet pipe, which was connected with the north end of the meter. Just above the point of connection was a vertical "shut-off" in the gas pipe. Below this point of connection the vertical pipe was continued two feet to a stop or drip cock, in order to free the vertical gas pipe of water resulting from condensation. When the drip-cock was shut there was no communication between the air in the meter room and the inlet pipe. When the pipe was open there was such communication, and, naturally, through the inlet pipe into the meter. After the meter was put into position the street main was tapped, and gas was introduced to illuminate the buildings at night. It was intended to cut off the communication with the street main as soon as gas was manufactured in the old works. It is evident that after the vertical gas pipe was attached to the inlet pipe, and the gas from the street main was introduced, the "shut off" was left open long enough for gas to flow into the inlet pipe and the meter in the proportion of one part of gas to seven of air. Mixed in these proportions, gas and air are as explosive as gun-cotton, and the meter was as dangerous as a huge bombshell.

Yesterday at one o'clock there were eight men at the works—Jas. McCormick, the overseer; a watchman; a blacksmith, Burns; Ford, a laborer; and three other laborers. Burns and Ford were directed to clean up the meter room. In gas works strict rules in regard to lights, smoking, and matches are enforced, but it appears that in the old works the system of surveillance was somewhat lax. This was owing to no gas having been made in the place for nearly four years, and no one had a suspicion that gas had flowed into the meter. Burns had a small kerosene lamp, known as a "petticoat lamp," with a naked flame, in his hand. Why he used it no one will ever know. It is believed that he took it into the building to light a pipe, since, after the accident, a paper which had contained smoking tobacco was found on the floor. A few minutes after one o'clock Burns and Ford were alone in the meter room building. The watchman was in a shed near the gate. Two minutes after Ford and Burns had last been seen a loud and sharp explosion occured, and glass, timber, pieces of iron, bricks, and other rubbish were thrown on the head of the old gasometer. Ford lay dead in the north-west corner of the room. His skull had been fractured by a portion of the north head of the meter. Burns was dead behind the inlet and exit pipes, which had forced him against a wall north of the head of the meter. He was killed in the same manner as Ford. His lamp, extinguished, was on the floor near him. The drip-cock on the vertical gas pipe was open, and the "shut-off" was closed. Both were within a foot of where Burns's body lay, and it was evident that, prompted by curiosity, Burns had turned the drip-cock and had applied his lamp to it. The explosion was instantaneous, and the heads of the meter, being flat, were carried away, while the cylinder remained intact. The bodies of Burns and Ford were carried to the purifying house, and Mr. Bradley was summoned. The dial of the meter and some portions of the south head were picked up in West 41st street. The north wall of the meter room was shattered, and will have to be taken down. The ceiling was demolished, and every window in the building was broken.

Mr. Bradley investigated the circumstances of the accident, and decided that it could only have occurred from a leak in the meter or the application of a light to the drip-cock. It was evident that gas had been introduced into the meter through the "shut-off" being opened for a short time. Mr. Rowland arrived after Mr. Bradley had made his investigation, and his first act was to visit the meter room and look at the drip-cock. When he learned that it was found open immediately after the accident, he said that this explained all. It was not possible, he said, for the meter or the connecting joints to leak.

Coroner Brady took charge of the case, and the jury, after hearing testimony, rendered the following verdict:

"We find that Charles Burns and John Ford came to their death by an explosion at the Municipal Gas Works on the 3d of December. From the evidence, we believe that the explosion was due to the carelessness of one of the above-named men entering the meter room with a lighted lamp."—*N. Y. Times*, Dec. 4.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
34 Pine Street, New York City.
December 16, 1880.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	*Par.*	*Bid.*	*Asked*
Gas Co.'s of N. Y. City.				
Central	466,000	50	60	70
Harlem	1,800,000	50	70	73
" Bonds	170,000			103
Manhattan	4,000,000	50	177	182
Metropolitan	2,500,000	100	135	140
" Scrip	$1,000,000	..	102	105
Mutual	5,000,000	100	70	75
" Bonds, gold	900,000	1000	100	104
Municipal	1,550,000	100	170	175
" Bonds	750,000		106	110
New York	4,000,000	100	102	104
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	112	115
Citizens	1,200,000	20	60	65
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	70	80
Peoples	1,000,000	10	28	33
" Bonds	290,000	...	90	95
" Scrip	250,000	...	75	85
Metropolitan	1,000,000	100	60	63
Nassau	1,000,000	25	47	52
" Ctfs.	700,000	1000	85	95
Williamsburgh	1,000,000	50	60	65
" Bonds		...	98	103
Kings Co	135,000	100	60	70
" Bonds	40,000	—	—	—
Richmond Co., S. I.	300,000	...	75	80
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	75	80
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.				190
Consolidated, Balt.			84	85
Bonds			109	110
East Boston, Mass		25	114	120
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Hempstead, L. I.	25,000	100	...	—
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150.000	40	117½	
Jersey City	750,000	20	150	160
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	70	80
Laclede St Louis Mo.	1,200,000	100	108	110
Montreal, Canada	2,000,000	100	148	149
New Haven, Conn		25	140	150
Oakland, Cal			35	36
Peoples, Jersey City		...	85	90
" " Bds.				5
Pittsfield, Mass			120	130
Rochester, N. Y.		50	70	80
" Citizens		100	30	35
Rondout & Kingston			75	80
St. Louis Missouri	600 000	50	250	254
Washington, D. C	1,500,000	20	215	225

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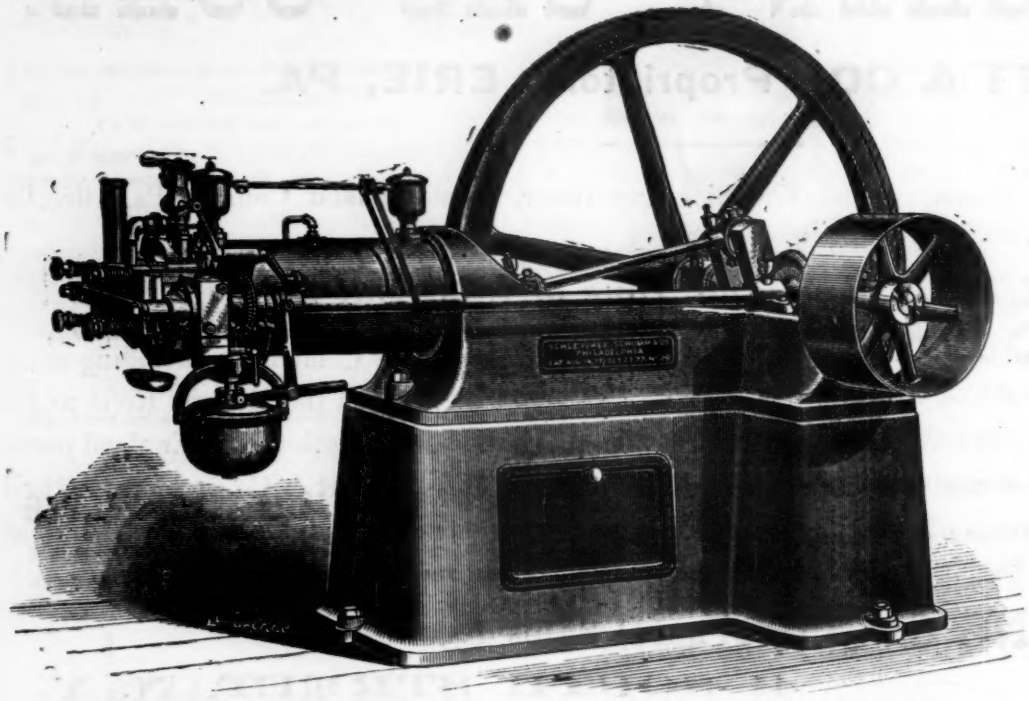

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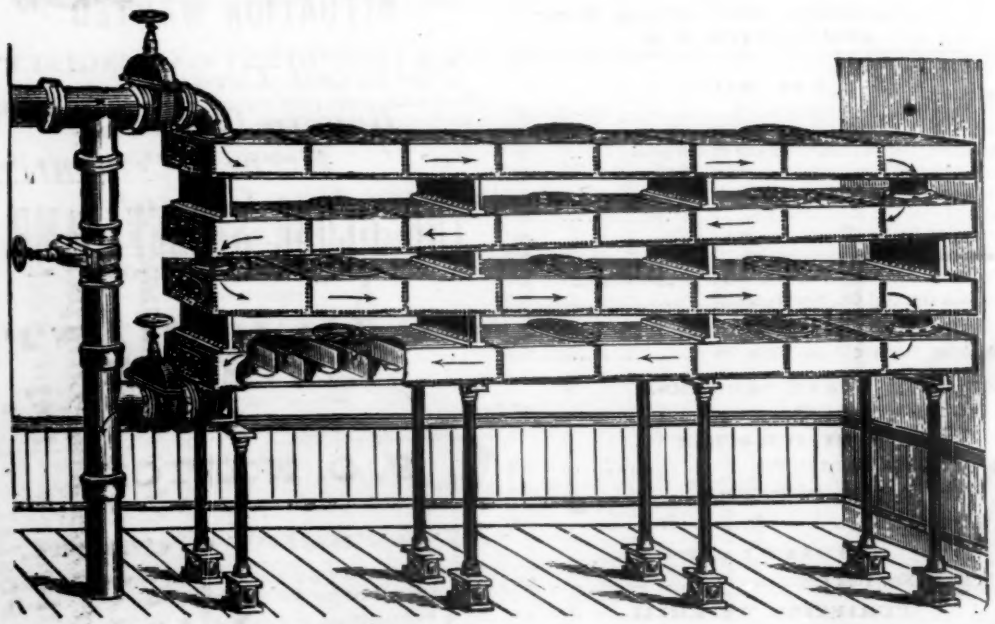

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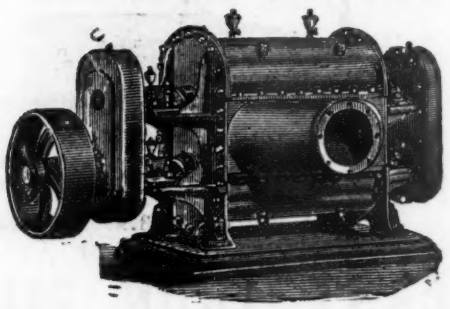

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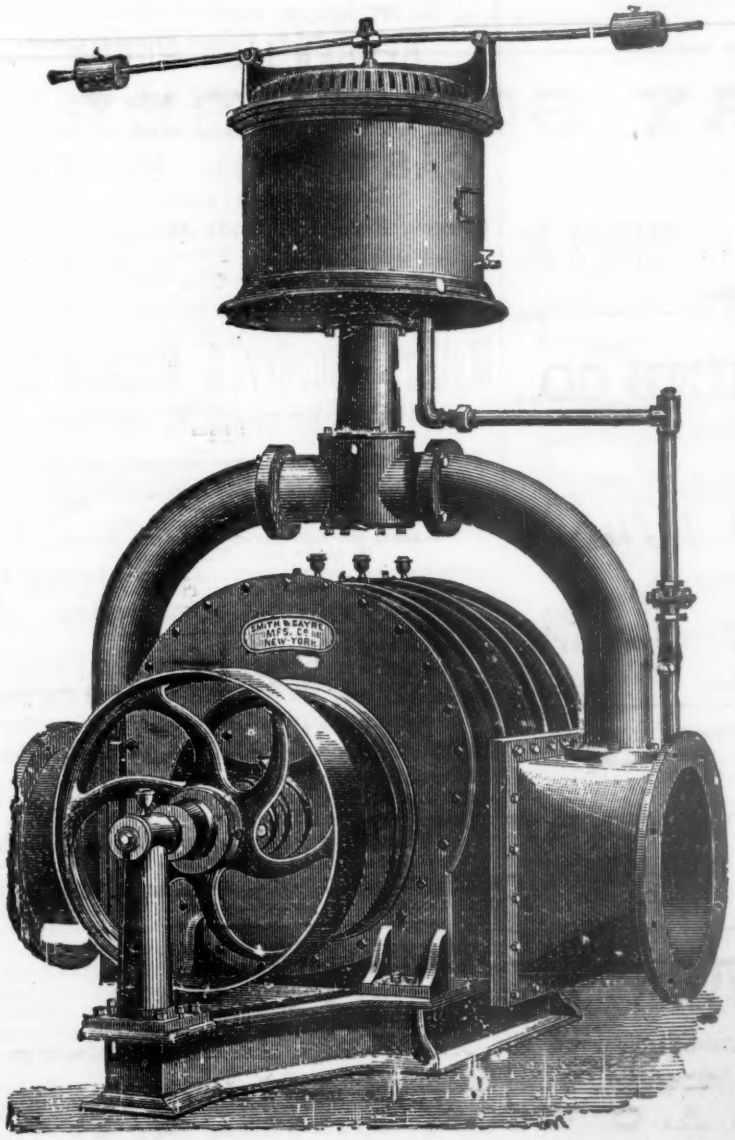

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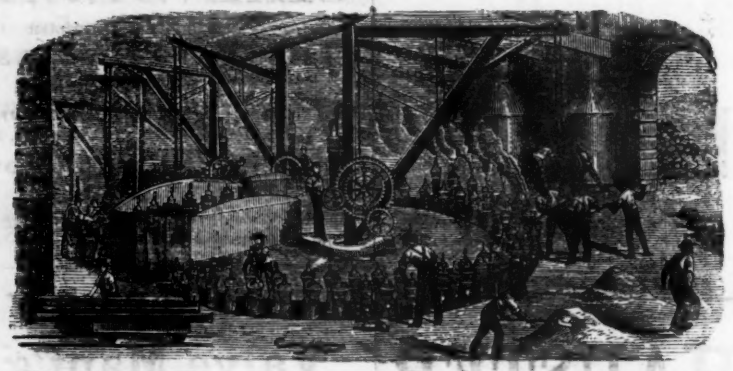

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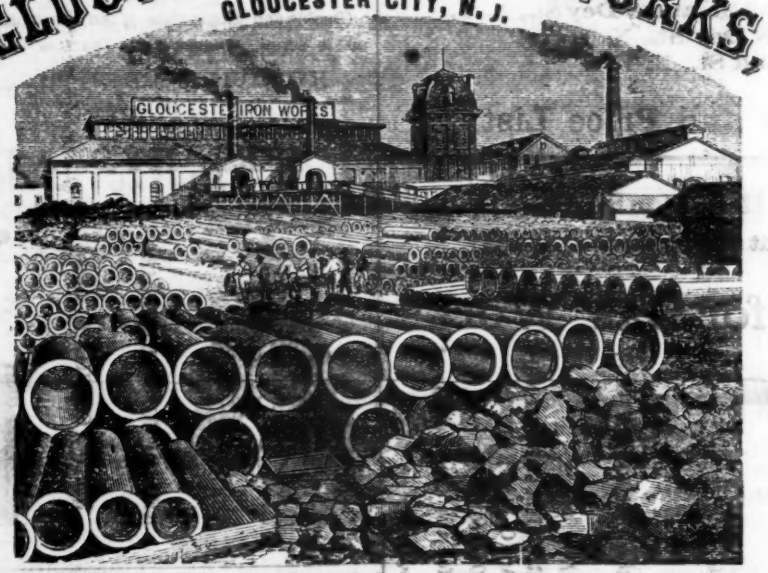

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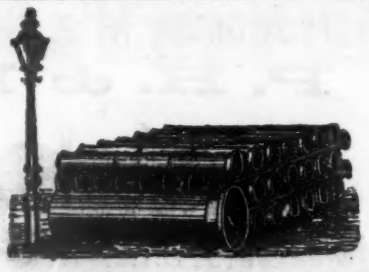

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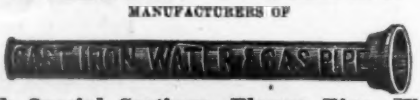

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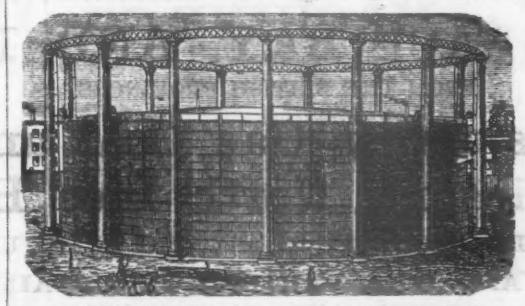

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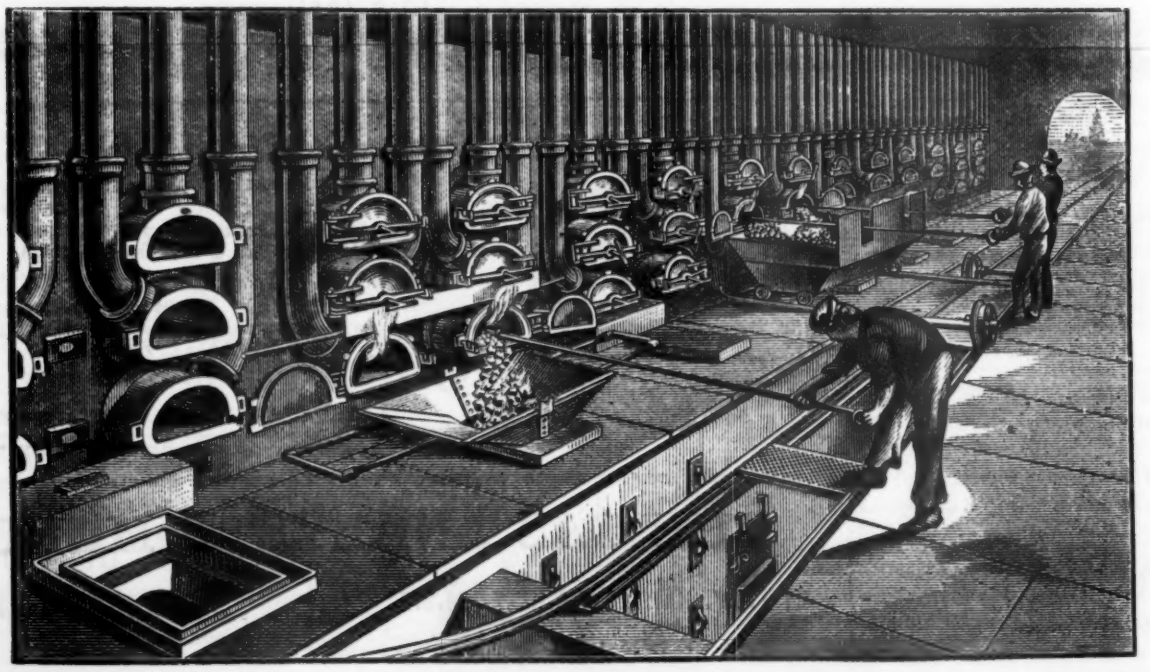

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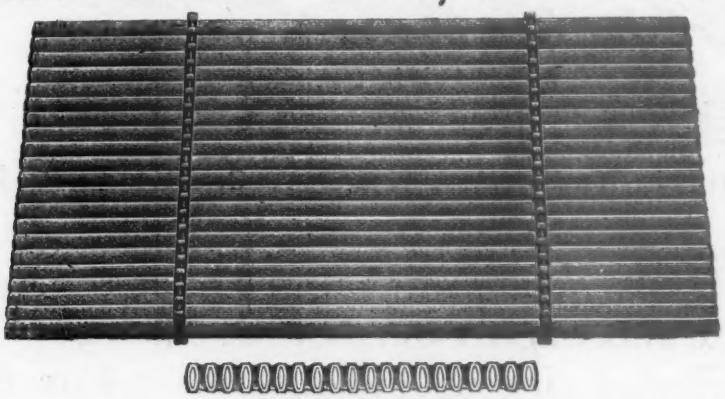

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